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CSL19 Design Excellence Analysis for Street Lights with Previous Products

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Abstract. Street lights are something that many people probably don't really think about. A lot of laypeople don't know much about streetlights. Lights on the highway are made with certain specifications with rules that must be met. In this analysis in collaboration with one of the lamp manufacturers who produce lamp products with design codes namely CSL14 and CSL19. It will be discussed about how and what things to consider for street lights. Field measurement results and measurement methods make the output results in the product test in the field makes a comparison of analysis data as a comparison. In this analysis will be discussed in terms of design geometrically the influence of LED light position placement, heat wasting system, lamp installation method, until the final results of product test in real field. Some of these will affect the lighting quality of street lights. From the final result, it can be concluded that the improvements made to CSL19 lamps are better than using CSL14. The design in CSL19 can be said to be better at improving the quality of light that can be evenly distributed and has higher energy efficacy.

INTRODUCTION

The shape of an LED street lighting luminaire is an important process for the final decision-making for lighting buyers, users, owners, and designers who will use it. On the manufacturer luminaire shape will become the final touch to giving more selling point and value to the product itself furthermore in the market. Many people decide based on what are they seeing in luminaire shape and less understand the main reason and factor of what the function of luminaire shape is to start from. The luminaire is a very inseparable connection to the components inside and they have a mutual symbiosis connection. How the luminaire can secure light source and other components such as drivers, electrical safety wiring, supporting components, and other control devices that must be protected all the time from external exposure (solid objects and liquids objects).

Luminaire also has a critical role to maintain humidity and temperature by transforming heat from inside into outside as a cooling system without absorbing the water due to the component inside, to make sure the luminaire system delivers maximum lifetime and performance [1]. So, luminaire has the function to make sure can fit stick firmly and tightly to attachment systems outside the fixture (such as poles, walls, and so on).

Trying to research at a lamp manufacturer in Indonesia. Find out more about how the lighting manufacturers to design and determine needs in the community marketplace. The development of technology has also become one of the factors lamp manufacturers keep abreast of and meet the market needs in the community. Through this research tries to discuss in terms of design and technology offered by lamp manufacturers to the public.

In this study, two designs were obtained which were coded CSL14 and CSL19. The CSL14 code was made before 2019, CSL19 is a design and shape designed in 2019 and discussions for the latest products and designs in 2020 with the design code CSL19N.

OBSERVATION

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In this study, it is necessary to know the relationship between the internal analysis component versus the final appearance of the street lighting luminaire and the case study of CLS 14 luminaires and CSL 19 luminaires. Scope analysis of the luminaire shape versus the following aspects such as:

- System LEDs.
- Heatsink system.
- Field installation methods.
- The output lighting that is installed in the field

Observe and study the design form and analyze the advantages and disadvantages of the lamp shapes designed in CSL14 and CSL19. Observations are made by taking measurements and observing physically.

CSL14 Shape & Specifications

The CSL 14 LED plates are housed in a closed compartment with clear tempered glass underneath to protect the LED PCB (printed circuit board) from external conditions (such as dust, oil, rain and heat), with the hope that the inside is well protected. CSL14 design form see figure 1.

This method actually has two contradictory consequences. On the one hand it is true that the LED PCB will be well protected, but the side effect after several installations the light intensity will decrease along the way due to external weather deposits as it has a double barrier layer. The first is the LED light barrier to the LED lens (called barrier I) and the second barrier from the LED lens to the glass layer (called barrier II). This will affect the decrease in the amount of light emitted by the fixture. From the perspective of the luminaire shape, the tempered glass on the CSL 14 also makes it taller and has extra weight due to the tempered glass inside.

As we know, led systems generate large amounts of heat [2], they must be equipped with an excellent colling system to release all excess heat over long hours and conditions. CSL14 has a heatsink with a stripped fin-like shape that extends throughout the outer body of the light fitting block. This cooling system is a passive cooling system. Since the heat exhaust system is placed on top, there is a possibility of a buildup of dust, moisture and dirt that can decrease the heatsink performance in releasing heat. Heatsink design in CSL14 is made in the form of a straight heatsink that is disjointed or given distance as in Figure 1. Design of the mounting bracket hooks on the CSL 14 made firmly attached to the body part over the lamp with die-cast frame reinforcement in it where the diameter of the pole is determined to stick with the holes provided and the absence of a regulator of the slope. on the shape and design of CSL14, Chip LED lights are used still uses the second generation in which the optical lens using borosilicate glass material.

Overall, the design of the CSL14 can be said to be the following paint on the lamp housing using the Standard Color gray polyester powder paint. The electrical component is attached to the back of the lamp which is detachable. Optical lenses are also coated with silicon on the sides. Tight silicone seal with protection index 66. There is an optical filter layer using tempered glass. Easy access to the power compartment and LED module by opening the cover. The side mount is adjustable for diameter 40 ~ 60 mm. Efficacy output 120 lm/W. High power factor PF> 0.95. CSL14 have dimming ballast and dimming systems gradually. Power protection with over voltage, short circuit and surge protection up to 10KV.

CSL19 Shape & Specifications

In CSL19 the new version of the LED PCB component is an option to overcome this problem because it has an outdoor Index Protection (IP) value on the PCB, is more powerful and sturdier so that tempered glass is no longer used. The results are reflected in the design of the LED PCB 19 CSL increasingly looks nice, the thinner and more improved in terms of weight and reduce the need for raw materials in terms of cost of manufacture. On the outer side paired rectangular aluminum plate which is equipped to cover the scope of safety for the LED PCB, as shown in Figure 2. The CSL19 design uses only one barrier, namely the optical lens which is attached to the lamp housing after the PCB plate. This optical lens has an index protection of 66 which has advantages against weather and dust to be waterproof. The optical lens used in the CSL19 design uses the 4th generation optical lens which no longer uses borosilicate glass, but instead uses acrylic material which has a protection index of 66. the change in optical lenses is also a factor in increasing the lumens of light so that the efficacy can be increased.

The CSL19 has a passive heatsink with a different shape from the CSL14, where the stripped fin shape on CSL14 is no longer applied but uses a straight fin line from end to end of the lamp body. Changes in the form of this heatsink is considered better than using fins stripped line. In this CSL19 used Parallel Straight Line method is considered better at throwing heat dissipation [2]. It has the same lamp body structure as the CSL14 design, it's just that the use of tempered glass is removed so that the optical lens becomes the outermost part of the lamp. The optical lens used uses a material that is not heavy and light made of acrylic. The increase in system lumen output is 142 lm/W with a power factor of $PF > 0.95$. CSL19 is also equipped with a ballast dimming system and a gradual dimming system. Power protection with over voltage, short circuit and surge protection up to 10KV.

CSL19 has a bracket system that can be adjusted to the tilt of the lights on the road, whereas the CSL14 does not exist. This slope adjustment is considered to be an important point in changing the shape and design because the light distribution effect can be adjusted by the inclination of the lights on the road, as shown in Figure 2.

CSL19 N series Shape & Configuration

In designing an electronic device, things that need to be considered are how the electronic device uses electrical power[3]. Along with the development of technology, of course the electric power used must be increasingly efficient. The development of lamp technology also prioritizes energy efficiency which is called efficacy. CSL14 has an efficacy of 120 lm/W and CSL19 has an efficacy increase of 142 lm/W. In the CSL19 N series, the efficacy has been increased again to 163 lm/W. The efficacy of the lamp is a strong quotient between lumens of light with power used to obtain how large lumens produced per unit of watts of power. The greater the lumens produced per watt of power per unit is considered better and more energy efficient [4].

Dimensional design on the series CSL19N transformed into 162 mm shorter than the previous design. This affects a lot on weight change in total and electronic design in LED light and optical lenses used. The use of optical materials has also been upgraded to the 5th generation where the distribution of lighting is better than the previous series so as to increase the number of lumens of light produced. Comparison CSL19N design and CSL19 series can be seen in Figure 3.

By continuing to adopt the light tilt adjustment feature on the CSL19, the CSL19N series remains flexible in regulating the tilt of the lamps that are mounted on different lamp posts. An increase in electronic components with a power factor of 0.97. The advantages of CSL19 which have a dimming system are also adopted in the system design in CSL19N.

THE EFFICACY OF HEAT AND OPTICS

In the literature study, it was found that there are various forms of heatsinks, namely pin, square and fin models. from a research study conducted by brother Rini at Mercubuana University [5] concurs with research conducted by Hou Fengze at Guilin University - China. It is found from several sources that the best heatsink is the shape of pins arranged aligned [6]. Shown in Figure 4. Based on the heat dissipation in Figure 4, according to the order of the best heat dissipation is the pin model, the second order is the fin model, and the last one is the straight-line parallel model.

In improving the efficacy of energy, heat energy is an element of energy transformation of waste products which can affect overall system, especially in the light [7]. In addition to the heat that need attention in order to improve the optimization of light output is optical. Optical lens has an influence in the distribution of light on a street light [8]. The effect of optics in lighting can be explained in figure 5. The light will have a shadow and an even illumination spot area [9].

RESULT & DISCUSSION

The CSL 14 form is highly functional, taller, denser, heavier form. Basically, it only functions as a compartment to secure the components inside by means of repair methods we can actually make the street lamp luminaire have a nice shape without compromising on performance, durability, mechanisms and so on. This will be a big leap opportunity process for street light manufacturers around the world, as their internal performance enhancements (lumens, light distribution, glare control, lifetime) have the change / to further enhance the physical appearance that changes from traditional thinking such as "Look functional" Change to "new stylist view".

Unfortunately, in the development of lighting design, particularly in street lighting applications, tilt adjustment is one of the last key factors in obtaining good street lighting results. This is very relevant to the current condition of

Indonesian PJU roads because there are many variations in road configuration types such as road width, pole position, arm length, including the angle of the street light pole which is always fixed from the pole manufacturer, the main problem here is the distance between the roadside. to the end side of the polearm which is often different from each road case in the actual implementation process (local out-of-town road connection).

This was then seen as a part that should be improved for the development of the CSL 19 by creating a new hook mount bracket streetlight which doubles not only as a mounting system but also as a tilt adjuster armature system which came in handy when we did. Another challenge is that when carrying out the aim tilt process in an actual installation condition it can be done in 2 conditions, first adjusting the aiming process before the installation process and secondly adjusting the aiming process after the installation process (after the fixture is installed on the highway light pole.) Which is very heavy and somewhat dangerous because of the weight of the equipment. However, this problem can be well anticipated by placing an additional bolt (two point to three point) on the hook mount bracket as reinforcement on the lighter CSL19 and CSL19N series streetlights.

CONCLUSION

The CSL19N shorter, stronger, lighter and the effects of touch and aesthetic form can create a good luminaire. This is indeed not the end of the solution process but it is true, the aesthetic aspect of street lighting luminaires will be coming soon and being implanted as part of the beauty element of city roads.

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REFERENCES

1. N. Lechner, *Heating, Cooling, Lighting: Sustainable Design Methods for Architects*, 4 ed. 2014.
2. H. Chen, S. Lin, dan C. Xiong, "Analysis and Modeling of Thermal Effect and Optical Characteristic of LED Systems With Parallel Plate-Fin Heatsink," *IEEE Photonics J.*, vol. 9, no. 2, hal. 1–11, Apr 2017, doi: 10.1109/JPHOT.2017.2670858.
3. P. R. Boyce, S. Fotios, dan M. Richards, "Road lighting and energy saving," *Light. Res. Technol.*, vol. 41, no. 3, hal. 245–260, 2009, doi: 10.1177/1477153509338887.
4. W. van Bommel, *Road Lighting*. Cham: Springer International Publishing, 2015.
5. R. Anggraini, A. F. Sudarma, P. Yuliarty, dan F. V.Enriko, "Perancangan Heatsink Untuk Lampu Led Menggunakan Simulasi Cfd," *Ind. Inov. J. Tek. Ind.*, vol. 10, no. 1, hal. 6–10, 2020, doi: 10.36040/industri.v10i1.2532.
6. F. Hou, D. Yang, dan G. Zhang, "Thermal analysis of LED lighting system with different fin heat sinks," *J. micond.*, vol. 32, no. 1, hal. 1–4, 2011, doi: 10.1088/1674-4926/32/1/014006.
7. H. Jang, J. Suh, C. Y.-J. of the K. S. Of, dan U. 2013, "A Study on the radiant Heat Characteristic According to Type and Array of LED Lighting Heatsink," *한국기계학회지*, vol. 12, no. 3, hal. 54–60, 2013.
8. A. M. Ylinen, L. Tähkämö, M. Puolakka, dan L. Halonen, "Road lighting quality, energy efficiency, and mesopic design - LED street lighting case study," *LEUKOS - J. Illum. Eng. Soc. North Am.*, vol. 8, no. 1, hal. 9–11, 2011, doi: 10.1582/LEUKOS.2011.08.01.001.
9. S. Wang, K. Wang, F. Chen, dan S. Liu, "Design of primary optics for LED chip array in road lighting application," *Opt. Express*, vol. 19, no. S4, hal. A716, 2011, doi: 10.1364/oe.19.00a716.

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