

"LED + smart" in highway tunnel lighting applications

Preface

With the rapid development of China's economy, people are increasingly demanding the quality of road lighting, highway tunnels have shortened mileage and the use of underground space characteristics, motor vehicle drivers feel when driving under the visual space, the tunnel inside and outside Of the brightness difference on the traffic safety is particularly large, in order to traffic safety and energy conservation coordination management, tunnel management center dimming control of the lights is particularly important. China's highway tunnels built up to 12683.9km, an increase of 15.2% in the world. How to improve the safety and comfort of highway tunnel lighting and reduce operating costs, has become the focus of attention of relevant departments, the use of energy efficient technology to reduce energy consumption to achieve "on-demand lighting" is imminent, in order to better improve the lighting quality and ensure traffic safety and comfort (LED) in the lighting has been vigorously promote the use of LED and intelligent control technology will be used in conjunction with the "need to change, energy-saving upgrade," the efficiency of the upgrade.

Tunnel lighting system

1.1 build system

China's transport and transportation roads extending in all directions, driving comfort by people more and more attention, how to let the driver through the tunnel from the bright into the dark process more comfortable, is to reflect the lighting designer of the tunnel lighting program design advantages and disadvantages The best interpretation. Tunnel lighting control system by the control center will be one or more groups of local area network programmable controller network, the unit programmable controller control of the group of tunnel lighting control system, environmental information detector to collect the environment outside the environment information and Passing the vehicle information, the application of fiber optic network will be the corresponding information sent to the control center server processing, and then transfer the dimming instructions to the tunnel sections of the LED lamps for dimming control. In order to ensure the brightness of the lamp after the implementation of the dimming instruction can meet the required value, through the real-time detection of lighting within the tunnel can not meet the lighting requirements, the control center according to the detection information for dimming, lighting brightness to meet the tunnel lighting quality requirements to ensure Vehicle driving safety.

1.2 system design quasi-side

Highway tunnels are divided into urban tunnels, mountain tunnels and underwater

tunnels. Due to the special difficulty of tunnel construction and the interference of two-way traffic lights, most tunnels adopt one-way traffic design. Usually the tunnel entrance section, overdue section, middle section and exit section of the lighting needs and quality are not the same daylight illumination from the entrance to the middle of the tunnel step by step diminishing, the middle section to the exit section of the illumination is gradually increased. With the high interest in "permeability" and "middle vision", as well as new technologies such as LED, intelligent control and wireless transmission, tunnel lighting will become more comfortable and energy efficient. Tunnel lighting should be combined with highway grade, tunnel length , Design speed, traffic volume and local weather and other conditions to be designed, should comply with the People's Republic of China Ministry of Transport issued the industry guidelines JTG / T D70 / 2-01-2014 <highway tunnel lighting design rules> the corresponding requirements.

1.3 "LED + smart" control

The "LED + intelligent" lighting system with innovative technology is composed of programmable logic controller, environmental information detection, vehicle behavior detection, power supply monitoring, and so on. In this paper, the "LED + intelligent" lighting system with innovative technology is used to control the number of lighting fixtures, Illumination monitoring, brightness control, communication network and LED lighting composition chart. When the traffic flow is large, the system is based on the open application of the protocol based on the fieldbus control system for LED lighting for stepless dimming management.

"LED + intelligent" lighting system of environmental information collector and vehicle behavior sensor to collect the tunnel inside and outside the brightness, traffic speed and traffic information, the illumination detector real-time monitoring of the tunnel illumination, monitoring the working state of the lamp, the system communication using optical fiber , Power line carrier or wireless transmission, etc., to ensure reliable data transmission between the equipment and the site and stable transmission to ensure that the control center can understand the lighting situation and traffic information in real time, the control center according to the corresponding test data through the system after processing The LED tunnel lights use the micro-control unit as the management module, the time control, temperature control, light control, current sharing, soft start and other technology integration (LED), the control system is used to control the lighting mode and brightness. Intelligent control interface, and 0-10V dimming program, with a wide range of dimming, power efficiency, signal transmission and stability of the advantages.

2 tunnel lighting quality

2.1 tunnel lighting product standards

Domestic tunnel lighting using tunnel lighting should be used through the national

3C mandatory certification of the control device lamps meet the national GB7000.203-2013 and GB7000.1-2015

2.2 tunnel lighting light quality

1 Visibility: Visibility is influenced by the background brightness of the tunnel and the surrounding environment. The visibility is related to the brightness of the wall, the brightness of the road and the flicker frequency,

2 reaction time: the occurrence of traffic accidents in highway tunnels is closely related to the reaction time of the driver. The tunnel lighting design should effectively shorten the reaction time of the driver to reduce the frequency of traffic accidents.

3 uniform brightness: tunnel lighting sections of the brightness to meet the JTG / T D70 / 2-02-2014

4 glare: glare is the field of extreme brightness contrast, the visual function of the decline or the eyes feel uncomfortable, tunnel lighting design should be based on environmental conditions and cloth light program to choose the right light to avoid glare

5 strobe effect: strobe effect is a certain frequency of change in the light, the observed movement of the object showed a static or different from its actual state of motion phenomenon. The optical design of the lamp, the arrangement of the cloth light is not continuous, and the brightness difference will form a strobe. Under normal circumstances, the frequency of the strobe is 2.5Hz-15Hz is acceptable. When designing the lighting scheme, consider choosing the appropriate installation distance , The installation distance of the tunnel light is 4m, the driving speed is 60km / h, the strobe frequency is 4.2Hz, and the driver will feel uncomfortable when the frequency of the strobe is between 2011Hz and the duration is more than 20S.

Concluding remarks

Tunnel lighting is an important part of transportation energy consumption, tunnel lighting energy-saving emission reduction has become the focus of the industry, through the "LED + intelligent" in the tunnel lighting promotion and application, the use of intelligent control technology advantages of tunnel lighting energy-saving optimization, Program design, through the combination of multi-disciplinary technology applications, complementary advantages, play "LED + smart" application advantages, and effectively promote the efficient and healthy development of tunnel lighting.