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WHITE PAPER

Construction Lighting: Illuminating the Jobsite

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ABSTRACT

Construction crews around the globe work in virtually every environment imaginable. Strict deadlines, late nights and battling Mother Nature is just another day at the jobsite. Proper lighting is necessary for the safety of everyone on and around the site and allows extended working hours to ensure jobs are completed on schedule. Road construction can be one of the most hazardous jobsites to operate in with the introduction of fast moving traffic, unfamiliar lane diversions and the glare of temporary and equipment lighting.

According to the U.S. Department of Transportation, driving or walking across a roadway is less safe in darkness than in a lighted area due to the reduced visibility. Though the number of fatal crashes occurring in daylight is about the same as those that occur in darkness, only 25 percent of vehicle-miles traveled occur at night. With that, the nighttime fatality rate is three times greater than the daytime rate. The Federal Highway Administration (FHWA) Signalized Intersection Information Guide reported that adding lighting could reduce nighttime crashes by 50 percent and reduce fatal crashes by 43 percent. This paper will take a deeper look at the lighting policies for work zones, as well as the solutions in the market today that offer the greatest safety for workers.

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INTRODUCTION

State Departments of Transportation (DOT) regularly use nighttime work zones to get necessary construction and maintenance done on or near the travel portion of a road to avoid the high volume daytime traffic. The U.S. Department of Transportation, the Occupational Safety and Health Administration (OSHA) and other agencies, provide guidance and regulation for lighting requirements on roadway construction sites. The goal is to keep workers safe from hazards while working in the evening hours, while also ensuring the safety of the public in traffic zones.

SAFETY AND POLICY

Lighting is an important factor that contributes to productivity and efficiency on a construction site. Poor lighting can affect the quality of work, especially in situations where precision is required. Inadequate lighting contributes to:

- Reduced worker efficiency
- Equipment and structural damage due to poor visibility
- Lost production time as a result of accidents
- Time off work due to personal injuries
- Possible loss of life

Most people prefer to work in the daylight, but that is not always possible with tight deadlines and changing seasons. The computation of illumination intensity at a working level can be extremely complex. Many variables are involved, such as light source, intensity, distance and more. Therefore, the illumination level at any work surface within a jobsite is best measured with a light meter reading in foot-candles, which is equal to 1 lumen per square foot.

In OSHA standard 1926.56(a), mandates the minimum foot-candles for particular types of construction operations. These include ramps, runways, storage areas and different jobsites. The requirements are:

LIGHT TOWER SOLUTIONS

Poor lighting is a jobsite safety hazard that can be prevented with proper placement of light towers and having the right type of lighting. The versatility that light towers provide: directional, high efficiency lighting; wide coverage area; and mobility, are what make light towers the most common lighting solution for construction sites, events, disaster relief or any type of temporary lighting application.

LED LIGHTING

Light-emitting diodes are tiny devices made from semiconductor materials that convert electrical energy into visible and near-UV wavelengths when they are assembled in a package and connected to an electrical circuit. Over the past decade, these tiny diodes have improved in color range, lumen output, color stability, lifespan and other areas allowing them to replace many other lighting technologies.

LED lights produce light that is directional so that the output can be focused where it is needed. Another advantage of LED lighting is that they are instant on, and can be dimmed, then be brought back to full brightness instantly. Metal halide lights do not switch on and off on demand, you have to wait for them to cool before they can restrike, which can be costly due to lost production time and potentially very dangerous on a jobsite. Unlike traditional incandescent bulbs, LEDs do not have a filament that burns out; and unlike incandescent and HID lamps, LED's do not generate as much heat and are not susceptible to vibration & breakage. Early LEDs emitted very little light, but with technological advances, LED efficiency and light output have increased dramatically, nearly meeting or exceeding metal halide.

METAL HALIDES

Metal halides are compounds formed when metal and halogen elements combine. Metal halide lamps produce light by passing an electric current through a combination of mercury and metal halide gas. A study carried out by The Dark Sky Society showed that the initial lumens of a 400-watt metal halide lamp are 20,500 and its rated life expectancy is around 15,000 hours. However, while a

Foot Candles (FC)	Area of Operation
5	General construction area lighting
3	Concrete placement, excavation and waste areas, access ways, active stor-age areas, loading platforms, refueling, and field maintenance
5	Indoors: warehouses, corridors, hallways, and exit ways
5	Tunnels, shafts, and general underground work areas. Exceptions apply: for shaft and tunnel heading, ten foot-candles is the requirement for mucking, drilling and scaling. Bureau of Mines-approved cap lights are also acceptable
10	In general shops or construction plants such as screening plants, batch plants, carpenter shops, mechanical and electrical equipment rooms, rigging lofts, active storerooms, mess halls, and indoor toilets and workrooms
30	First aid stations, infirmaries, and offices

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metal halide bulb has a very high light output initially, it loses its lumens very quickly. When the bulb gets to half of its lifespan, between 8,000-10,000 hours, lumen depreciation may as low as 50%. Metal halides are also omnidirectional; they distribute light in every direction, meaning a lot of the light that is produced is wasted since fixtures cannot reflect 100$ of the light. They also have the longest warm-up period of any light on the market. Many metal halide lamps take 15-20 minutes to reach their normal operating temperature. They are also extremely susceptible to vibration and breakage, and most deployed in mobile light towers never reach their rated life expectancy, or even half of it because of breakage.

BALLOON LIGHTS

Balloon lights typically apply to workstations or mount onto equipment or vehicles. The lights have air inflated covers made of light-diffusing fabric placed on stands. The balloons themselves are very fragile and require a high wattage to produce enough usable light.

DIFFUSED LIGHTING

Increased and widespread use of artificial lighting distorts the natural view of our environment and can impair our safety, energy and health. Glare due to light trespass can cause a loss of visibility and even induce pain from overly bright and ill-placed light sources. Un-natural lighting can alter colors of important safety warning signs, make it difficult to discern depth and distance due to shadows, and even disrupt circadian rhythms, making it more difficult to sleep.

Researchers say well-designed LED lamps can cut down on the amount of wasted light the bulbs emit without creating a noticeable difference for human users. Unlike directed light, which produces shadows and reflections, diffused light produces uniform, soft illumination over the entire space, making objects more visible while reducing shadows or reflections. Light diffusers work by scattering and dispersing light, creating softer, less harsh lighting.

LIGHT TOWER LINKING

As contractors and municipalities look to reduce CO2 emissions, cut acquisition and fuel costs, electric and linkable towers are gaining popularity. Linking or daisy-chaining light towers together can be very cost effective as a jobsite lighting solution. Consider a remote location where you might need four light towers. Instead of having four diesel engine driven light towers, you could have a single engine powered tower and easily connect three, less expensive, all electric, plug-in models, saving on fuel and maintenance costs, while still getting the same light output. Owners can benefit from lower operating costs, increasing profits and a decreased total cost of ownership.

Every application requires a different solution and a different number of light towers deployed to cover an area. Considerations need to be taken to insure the power source selected has sufficient export power and the right receptacles to connect the linked towers. Proper extension cord gauge and lengths must be used to insure sufficient current carrying capability and to avoid excessive voltage drop. The plug-in market is expected to continue to grow as users become aware of the many benefits associated with this type of lighting solution.

CONCLUSION

For jobsites to work effectively and safely, it is important that the work area is well lit. If a site does not meet minimum lighting requirements, workers, the project and the public are all at risk. Appropriate lighting levels help everyone stay safe and stay compliant with local and national regulations. Consideration of the impact lighting has on the surrounding environment is necessary when working in and around public spaces. Generac recommends working with one of our factory trained professionals to ensure the best lighting solution for your unique project.

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