

Jessie Dvirnak

December 17, 2012 3206 Main Avenue

Mr. Levi Lloyd, Streets Manager

Streets Division of City Operations Dept.

105 Sawyer Dr.

Durango, CO 81301

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Dear Mr. Lloyd,

As a relatively new driver, I have noticed that it is somewhat difficult to see an approaching crosswalk when driving at night. Although reflective crosswalk signs are occasionally present, drivers do not always see pedestrians on the crosswalk until they are nearly at the point of impact. Therefore, the crosswalks should be made more visible by applying a glow in the dark coat of paint coat over the top of crosswalk paint.

The most common way to make an object glow in the dark is by using phosphor, a synthetic phosphorescent substance. Phosphorescence is a specific type of photoluminescence that does not instantly re-emit the radiation absorbed. This can be described as an excited state. During this state the atom acquires energy through light. That energy is released through increased vibration of the atom, which returns back to a lower energy state through the process of absorbing, then emitting photons. For this reason, the radiation absorbed is slowly released at a lower level of light causing a glow that can last up to several hours. This can be similarly compared to a battery. The battery is being charged by an energy force for a long period of time causing the battery to absorb the energy and then slowly release it. In the case of crosswalks, the sun will be the source of energy “charging” the photons creating a glow for several hours during the heaviest pedestrian use in early evening. Gaining energy and storing in vibrations.

B

2

A

C

1

The bottom line labeled with a “1,” displays the fully stable state of the electrons. The red lines labeled “A” represent the sun charging the electrons which causes them to travel past the semi-stable state labeled “line 2.” The three purple lines labeled “B” show the electrons falling instantaneously back to the semi-stable state. These electrons remain in the semi stable state for a specific duration of time. This is when the glow begins occurring. The black line labeled “C” illustrates the electrons falling back down into their fully stable state. When the electron falls into its lower level it does so by emitting photons. This photon is the light seen in glow in the dark materials.

Compounds such as zinc sulfide and strontium aluminate are typically used as pigments in phosphorescent safety related materials due to their higher level of luminescence. Phosphorescence, a specific form of luminescence, emits light in a slow delayed manner when electrons are “kicked up” to a semi stable state and have a slow fall back down to a stable state. Though zinc sulfide and strontium aluminate are most commonly used, strontium aluminate has an average of 10 times brighter luminescence than zinc sulfide does and therefore is more commonly used. Strontium aluminate (SrAl2O4) is a nonflammable, low soluble, solid, pale yellow powder which is chemically and biologically inert. This inability of chemical and biological change and low solubility will insure that outside forces such as rain, oil leaks from cars etc. will not have an effect on the paint itself and the paint will not runoff into the Animas River and pose a threat to water quality. When activated with an appropriate dopant, it behaves as a photoluminescent phosphor with a long occurrence of phosphorescence (this dopant will already be added to the paint mixture so it will not cost the city anymore time or money). A dopant is a substance added in small amounts to a pure semiconductor material to alter its conductive properties. In this case, the dopant is more of an activator which determines the duration of time of the “afterglow” and the wavelength the phosphorescent glow is emitting. Some dopants include boron, phosphorous, antimony, and arsenic. When strontium aluminate is applied as a pigment within the phosphorescent paint, a green glow will be present. This represents the effect of the sun exciting the molecules within the paint all day and having them slowly fall back down to their most stable state. Consequently when this layer is applied over cross walk paint, a glow will be present in the dark.

According to Transportation for America, over 47,700 (about 5,300 a year) pedestrians have died from being struck while crossing the street between the years 2000-2009. By applying a coat of phosphorescent paint to the crosswalk, this will not only enable pedestrians to see the location of the crosswalk, but it will give drivers further advance notice of the crosswalk. The cost of regular paint for crosswalks can start at as little as eight dollars a gallon. However the price can go up depending on what type of crosswalk is being made. A gallon of paint is estimated to cover around 350 square feet. The dimensions of the individual strips of paint creating the crosswalk are around eight feet by one foot. with an average of 10 stripes across the street. Basedon this information, a crosswalk covers about 80 square feet. (in paint) enabling the city to make four crosswalks per gallon. Phosphorescent paint on the other hand could cost roughly anywhere from $400-$500 per gallon. However, with a proper sealant, phosphorescent paint can hold its glowing property up to 10 years and therefore would only need to be reapplied when the crosswalk paint is reapplied, twice every year. This would still be cheaper than the installation of flashing signs which cost over $25,000 to install. The cost is also contingent on the quantity of lights purchased and location of installation. In regards to this high price of phosphorescent paint, there may need to be designated areas assigned to where the paint is applied. In Durango, I would suggest applying the phosphorescent paint on 3rd Avenue, San Juan College, College and Camino, the Train Station, Durango High School and Animas High School crosswalks due to the high traffic and limited visibility.

In addition, the glow of the paint will give a very slight outline of the pedestrian so drivers are more able to see the walker. As a result, there will be fewer fatalities and injuries of pedestrians each year. Furthermore, Durango is a popular tourist destination; therefore it is in the city's best interest to keep our residents and tourists safe where pedestrian traffic is heavy. Durango is also an area where biking is one of the main modes of transportation; these bicyclists are notoriously difficult to see at night. This innovative solution to pedestrian safety will not only protect lives, but could add an additional attraction giving people one more reason to visit Durango. Though the phosphorescent paint for the cross walks is not necessarily inexpensive, a plan could be implemented to make it cost effective. Ultimately, it is difficult to put a price on life.

I appreciate your time and consideration of my ideas and I welcome any suggestions or feedback.

Sincerely,

Jessie Dvirnak, Animas High School.