

The Need For High Visibility Apparel

By Kirby Beck

The FBI's 2003 Law Enforcement Officers Killed and Assaulted report shows that since 1994, 116 officers were killed as a result of being accidentally struck by motor vehicles. They were on traffic stops, roadblocks, directing traffic, or assisting motorists at the time they were struck.

Anecdotally, however, most police officers that have been on the job more than a few years can name at least one officer they know who was struck, or nearly struck, while on foot near traffic. It is safe to say that several hundred officers around the country are struck each year while walking outside of their patrol vehicles. One other factor would stand out if the data was collected. Nearly 100% of the drivers involved would say that they never saw the officer in time to avoid hitting him.

A driver's attention is usually drawn to an object in or near traffic based on its size, brightness, movement, contrast, or threat (necessity). Officers are wise to incorporate all—except perhaps size—in their tactics to be seen while near traffic. This process of enhancing one's ability to be seen by drivers, and becoming more conspicuous, is known as enhancing one's conspicuity (rhymes with "annuity").

Physical Factors

Have you ever heard your parents, or perhaps other senior adults, say that they just can't see to drive at night anymore? Age has a serious effect on a person's vision and it is particularly noticeable at night. With age, people will naturally lose visual acuity. In other words, their ability to see things sharply diminishes. As their eyes lose flexibility and resilience, their ability to focus quickly and clearly is reduced. Age can narrow one's peripheral vision and reduce color vision and brightness.

The effect of aging on night vision is truly scary. Experts estimate that people lose about one-half of their night vision every 13 years. This occurs due to several factors. First, the eyes are filled with a liquid known as the aqueous humor. As cells within the eye die—as all cells eventually do—the dead cells end up floating around inside the liquid. They are absorbed very slowly. The increasing accumulation of cells eventually affects the ability of light to penetrate through to the retina in the back of the eye. In the daytime, and when there is a lot of light, it isn't much of a problem. At night, when there isn't much light, it is very noticeable.

Second, the retina is made up of receptors known as rods and cones. The cones provide our color vision as well as our clear, focused vision. The actual "focused" area is less than we would see if looking through the inside of a toilet paper roll. It may actually be closer to looking through a straw. We aren't aware of the focused area is so small because we are constantly moving our eyes to compensate. To get an idea, stare at this WORD and, without moving your eyes, see how many words around it you can see clearly.

The rods make up the largest part of our vision. Rods support both our black and white and peripheral vision. The rods emit and work together with a chemical called rodopsin—also known as visual purple because of its color—that assists the eye in seeing at night. Imagine you are sitting in a darkened room. With time, you will eventually be able to see quite well as your eyes adapt to the darkness. Suddenly the overhead lights in the room are turned on, and then off again.

Your ability to see as well in the dark will be gone until your eyes once again adapt to the darkness. The process of adapting is the result of the buildup of rodopsin. When the light was turned on, the rodopsin suddenly burned up. It takes time for the chemical to again regenerate. As a person ages, it takes even longer for rodopsin to regenerate. Simply put, no rodopsin, no night vision.

The final described effect of aging is the condition of the lens itself. The lens can turn somewhat yellow and reduce the amount of light getting through. More than likely, though, the most noticeable effect will be a result of scratches on the lens. Eyes are subjected to sand, dust, and other airborne particulates that float through the air and strike them. Look at the pitting on your car's windshield and you get an idea of what can happen to the eye's lens over time. This irreparable damage can reduce visual acuity; it can also enhance the effects of glare—glare from headlights, glare from sunlight, and even the glare reflecting off of the car's dashboard.

Most of the changes of age are gradual and change isn't obvious. But at night, the changes become most noticeable, and, consequently, most dangerous. Officers who work in areas where significant numbers of seniors drive at night need to be particularly aware and prepared while walking in or near traffic.

Environmental Factors

The effects of aging can be recreated by weather and by the condition of a car's windshield and headlights. Rain or a dirty, pitted windshield can act to enhance glare both day and night. Fog and poorly aimed headlights can reduce the distance that a driver can identify objects and people.

Psychology was mentioned as a cause of concern for officers walking in traffic. Drivers essentially “see” what they want to see—a concept known as “selective perception.” For example, as drivers approach a scene with flashing lights and numerous emergency vehicles, they may be more interested in looking at the crushed metal and broken bodies than in watching for an officer directing traffic or crossing the roadway.

Since the drivers are looking for carnage, not pedestrian cops, they are not as likely to see an officer standing in front of them. Officers need to overcome this selective perception by employing one of the tactics which the driver's brain and scanning eyes are unconsciously conditioned to be alert for: movement, size, brightness, or contrast.

In April of 1984, a research company called Dunlap and Associates, working on a US Transportation Department contract, conducted research on common conspicuity devices designed to protect both pedestrians and bicyclists. Using the quiet, darkened roads of a military base, they established the average distances at which a group of drivers both detected and recognized people both with and without various conspicuity devices. A driver must first detect a potential threat before he can recognize it. Once it has been recognized and precisely located, the driver can more successfully avoid the object or person.

The findings most important to LEOs are the detection and recognition distances for pedestrians wearing dark clothes, because this is what the majority of police officers in the United States wear. Note: In this study, the driver's sole purpose was to be on the lookout for people near the roadway. The research environment did not include parked police cars, flashing lights, or any other distracters.

At 30 mph, or 44 feet per second, the average distance of the driver from the subject in the dark clothing when detected was 70.3 feet and 1.5 seconds. The pedestrian was not actually recognized as a pedestrian until the car was 49 feet and 1.1 seconds away. When extrapolated to 55 mph, or 81 feet per second, it gets even scarier. With the detection distance of 70.3 feet, the reaction time is now 0.86 seconds. Recognition time from 49 feet away becomes 0.6 seconds. If the pedestrian in dark clothing is in the traffic lane, as police officers often are, it is virtually impossible for the driver to avoid a collision.

Without getting too detailed, the study also showed that wearing a white shirt, as a number of officers and deputies do, did not substantially increase detection and recognition. White shirts are not an adequate substitute for other conspicuity devices.

Adding a flashlight to the scenario extended the detection time out to 1379 feet (31.3 seconds at 30 mph) and the recognition to 316 feet (7.2 seconds at 30 mph). Of course, the flashlight had to be pointed at the driver and then moved a bit to enhance detection. Remember, however, these results were obtained with zero traffic on abandoned roadways. The results on a high-speed roadway with heavy traffic would likely vary a lot!

When they added a traffic vest (crude by today's standards), the detection distance was 744 feet and recognition distance was 322 feet. With 7.3 seconds at 30 mph, and 3.9 seconds at 55 mph, to make a plan to avoid a collision, odds of survival are increasing. Combining a flashlight with a vest (especially the high quality vests of today) and the officer may now have a real chance of getting a driver's attention soon enough to be fully recognized and reacted to safely.

This threat has to be truly understood and recognized before some officers will make a plan and commit to using their issued safety equipment. Hopefully the threat is clearer now.

Safety Equipment

Many new police officers are handed their new traffic vest—their OSHA vest—with the plain and simple instruction to: “Wear it when you are out in traffic.” This is usually taken to mean when they are out directing traffic. Soon it is stuffed into the bottom of a patrol bag, or left in corner of their locker and rarely seen again.

If the order to wear it whenever they are “out in traffic,” were truly followed, they would probably never take it off. After all, every time an officer crosses a street, walks in a parking lot, approaches a violator on a car stop, or checks on a disabled motorist, he is, in essence, out in traffic. It is an unavoidable fact—police officers are almost always in or near moving traffic.

The police uniforms worn today do nothing to enhance the officers' conspicuity in traffic. The technology to do so exists, but paradigms and old ways of thinking about uniforms have to be changed before the uniforms do. In the United Kingdom, Europe, and elsewhere, police have been wearing “Hi-Vis” jackets and vests for a number of years.

The reason is simple: they want police to stand out in a crowd so that they can serve as a deterrent to crime and so that people who need assistance can spot them more easily. The secondary benefit is officer safety in or near traffic. In the UK, unlike in the US, it is a standard mandate by law.

Their Hi-Vis jackets are made of a fluorescent yellow (lime/yellow actually) material with several broad stripes of retro-reflective material around the body, arms, and shoulders. The stripes outline the basic shape of a person, important in the recognition phase of driving. The UK officers don't mind wearing their Hi-Vis jackets because they have seen their effectiveness in both keeping them safe and in deterring crime.

As hunters and road workers have discovered, fluorescent colors like blaze orange and fluorescent yellow have a near magical effect in dawn and dusk light. The colors almost seem to glow. Fluorescent colors work because they reflect back more light than they absorb. Special molecules in the material do absorb certain types of light, especially ultra-violet light, but re-emit or reflect them back in longer wavelengths that are more visible to the human eye. Because UV light is so prevalent during cloudy days and at dusk and dawn, it explains why fluorescent colors are so effective during those conditions.

Some think that fluorescent colors are effective at night, but it is quite the opposite. Because fluorescent colors require sunlight to reflect back, they aren't at all visible at night. As light diminishes, fluorescent colors appear to turn black; therefore, even fluorescent fabrics must include retro-reflective material for effectiveness at night.

Using bright and contrasting colors in jackets and clothing can also create somewhat high visibility daytime uniforms. Many bike patrol officers around the country are wearing two-tone jackets in color combinations like yellow and navy or royal blue and navy. While still not as effective as true fluorescent Hi-Vis colors, these two-tone jackets do stand out better in traffic. Some police agencies around the country are slowly allowing their patrol officers and other specialists to wear these two-tone jackets and rainwear.

Nighttime Technology

Retroreflective material began development nearly 50 years ago. 3M™ and their Scotchlite™ reflective materials have been the major player in retroreflective research and production. The most commonly used retroreflective products are a silver color. This is because they consist of small glass beads imbedded in a metalized layer and bonded to heat-activated adhesive or fabric backing.

But technology today is changing, and options may become available to the ubiquitous silver color. The reflective material is beginning to take on many different colors, including those found on police uniforms and jackets. Some of these fabrics even enable manufacturers to make the entire garment out of it. The color may appear to be dark blue, or a similar color, but when it is struck by directed light, it shines back in the traditional silver color.

Although this technology is not yet as bright and effective as the traditional products and doesn't meet occupational standards, it may not be too long before it is perfected. Companies must and will find a way to attach reflective stripes and dots to various areas of a police uniform to show movement and outline the human body when illuminated by vehicle lights. This will enhance officer safety without a separate garment.

Retroreflective materials are essentially small mirrors. They reflect light directly back toward the light source that strikes it. They do not retain light like so-called photo luminescent materials. A good number of officers fear that any retroreflective material on their uniform will somehow "give them up" in tactical situations. But they will not glow like the face of a Navy Seal's watch.

The reflective effect is only visible within a very small observation angle. If an observer is more than 3 degrees away from the light source, the reflector will not be seen. For example, if your partner is standing roughly 15 feet or more away at your side, pointing his light at someone wearing a retroreflective vest, your partner will see the reflection quite brightly. It is very likely that you won't see the reflection at all. This is because you have exceeded the 3 degree observation angle.

IPMBA Police Cyclist Instructors (PCIs) are all given a demonstration during their training to show them the real effect of retroreflective materials. Two students are selected. One wears a garment with a large amount of retroreflective material applied to it. The second has no retroreflective material at all, but he will wear a large metal badge on his left breast. The class of observers stands a distance away while the two volunteers walk towards them out of the darkness and stop directly under a streetlight. What is seen surprises many.

The officer wearing the retroreflective material is visible, of course, but there is no reflection off of the highly reflective uniform. The officer wearing no reflectors is also visible under the light, but a bright object clearly sparkles on his left breast. New PCIs learn that in order for a person to see the reflected light from the officer's uniform, he would have to be within 3 degrees of the directed light. In this case, the person would have to be on top of the streetlight to see the reflection.

Ironically, while many officers and administrators reject using uniforms with retroreflective material, they don't hesitate to wear a large metal badge with shiny mirror-like angles that can direct light in many directions. While large metal badges are

beautiful, and worn with pride, embroidered cloth badges on outerwear are tactically much better at night if you don't want to be identified at a distance.

Where Do We Go From Here?

Uniforms should be designed and worn that take into account the most common light source, vehicle headlights. They must highlight movement, identify the wearer as human, and provide 360° degree protection. It should not require putting on a special garment, like a vest or jacket. We have already seen how often this system fails. The reflectors should be always there, working passively in the background, ready to protect the officer anytime he is on a car stop, or otherwise near traffic.

Officers needn't fear wearing these garments. They should be more concerned when they don't. Take a look at a fire fighter's turnout gear or the jump suits worn by flight medics. The retroreflective stripes are strategically applied to give the wearer an easily recognizable moving human form, protection that is always there helping them to be detected and recognized sooner.

To be most effective, reflectors should be applied near wrists, at the waist, across the back, and even near the bottom of pant legs or around the knee. Retro-reflective patches can be applied to the back of shoes or boots. Some might be applied to a Sam Browne belt or some of the equipment cases. Adding a large POLICE emblem, made with retro-reflective material, to the back of shirts and jacket is also helpful.

Improving LE uniforms will require "thinking out of the box" and examining our views about uniforms. After all, what is the purpose of a uniform? They are supposed to both identify and protect the wearer. Few of our current uniforms truly meet these criteria at night.

The Federal Highway Administration's most current revision of the Manual of Uniform Traffic Control Devices (MUTCD) has a section addressing roadway workers that includes police and other first responders. The manual essentially codifies the use of certain protective clothing anytime a worker is working near the roadway. They will require the use of equipment that meets ANSI Class II and Class III protection level standards by approximately 2007. These are the highest standards for the greatest number of threats. The requirements will be enforceable by OSHA.

There is good news. Most of the uniform manufacturers are aware of these conspicuity issues and requirements. They have designed uniforms for other public safety workers that already incorporate many of the safety features discussed. The companies are more or less waiting for law enforcement's image of their uniforms to catch up to existing technology.

Though fabrics have changed, police uniforms look about the same today as they have for decades. Our outdated perceptions about uniforms may well be putting officers at risk, especially at night. Despite the fact that departments issue their officers Hi-Vis traffic vests, few are wearing them during most of their exposures to traffic threats.

Police officers don't wait for a gun call to don their body armor. They wear it throughout their shift, passively present in the event that it is needed. The dangers officers are exposed to in traffic are equally deadly, and, truth be known, may be more frequent.

Virtually every motorist who runs down an officer didn't intend to do so. This makes them even less predictable and more numerous than criminals with guns. Hopefully, law enforcement will someday step away from their long held traditional uniform models and modernize with clothing that will better protect them from all of the threats that can injure and kill officers.

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