



SAFETY THROUGH LIGHTING

DVN MICHIGAN WORKSHOP 2021

Shammika Wickramasinghe
21st–22nd September 2021

Confidential ©2019

WHY IS LIGHTING IMPORTANT

WHAT ARE THE REGULATIONS



- Lighting defines the vehicle and the brand (the face of the vehicle and lasting impression).
 - Clean crisp lines / bold statement
 - Lighting Signature is linked to the brand
 - Visible day & night before you see the logo.
 - Night time driving comfort and alertness – maintained by good interior / exterior lighting
- The European automotive industry is one of the most heavily regulated sectors in Europe with more than 100 EU Regulations and 80 Directives covering the sector's activities.
- Similarly in the USA NHTSA maintains more than 70 federal motor vehicle safety standards covering the full range of safety-relevant vehicle performance parameters, from occupant protection to headlight illumination levels.



World wide there are more than 50 regulations and artefacts applicable for lighting of a vehicle

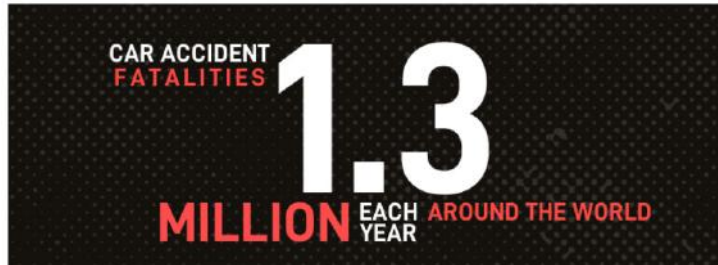


STATISTICS

ACCIDENTS AND CAUSES



Global Car Accident Statistics



According to safer America.com - every year, roughly 1.3 million people die in car accidents worldwide – an average of 3,287 deaths per day.

U.S. Fatal Car Accident Statistics

In 2019, 38,800 people were killed in car accidents in the United States

48 percent of all fatal accidents took place during night-time conditions and of these accidents, 41 percent occurred in dark.

According to US Statistics - **more than 40% of all fatal car crashes happen after the sun has set. This is a jarring statistic seeing as though there's 60% less traffic on the roads.** That means that your risk of getting in an accident is much higher at night.



STATISTICS

NHSTA INFORMATION ON ACCIDENTS



The Insurance Institute for Highway Safety also assessed contributing factors that increase the risk of a severe or fatal accident while driving at night.

- Drunken driving
- Speeding
- Drowsy/Sleepy driving
- Poor visibility

The takeaway from this study is that **even though there's less traffic on the roads, nearly half of America's fatal collisions happen at night.**

According to a study done by a LA Law firm - common reason for collisions is the lack of stopping distance.

It's important to determine how far away you are from the vehicle ahead of you according to the illumination provided by your headlights. Typically, low beams create a visual area of up to 160 feet away, where high beams illuminate up to 500 feet to see ahead. If you have to make a sudden or hard stop, leave enough distance based on those distances.



NIGHT DRIVING FACTS



Since our ability to perceive and judge distance is severely impaired at night - the human eye requires light to see - **night driving is a top cause of car accidents. An estimated 90 percent of all driver decisions are made based on what they see.** While your eyes are capable of seeing in limited light, the combination of headlights and road lights, with the darkness beyond them, can cause several problems for your vision. Therefore, car drivers must take extra precaution to avoid an auto accident during the night.

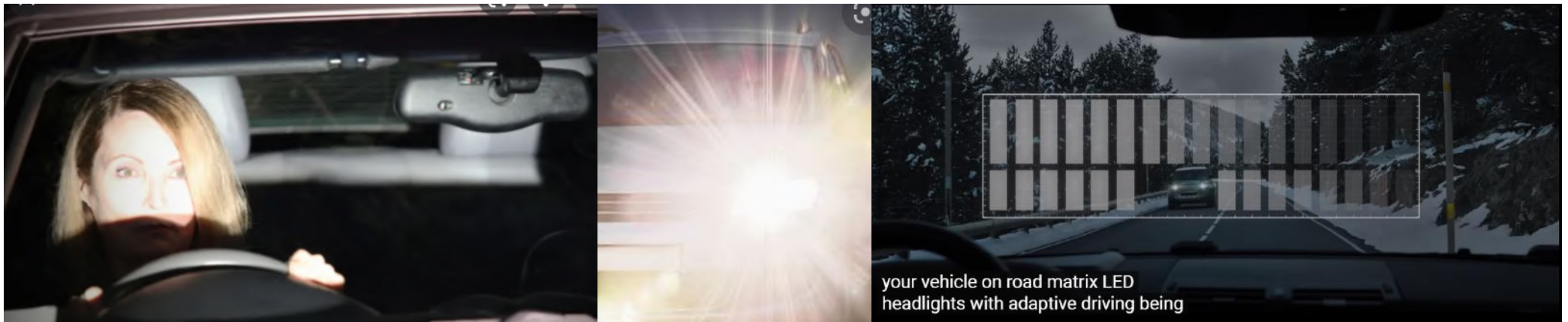
Driving either just before sunrise (dawn) or immediately after sunset (dusk) are also very dangerous time periods on the roads. The problem is that while the sky is still well lit, the roads begin to get dark causing a disparity between light and dark and can cause vision problems for drivers.



NIGHT DRIVING FACTS

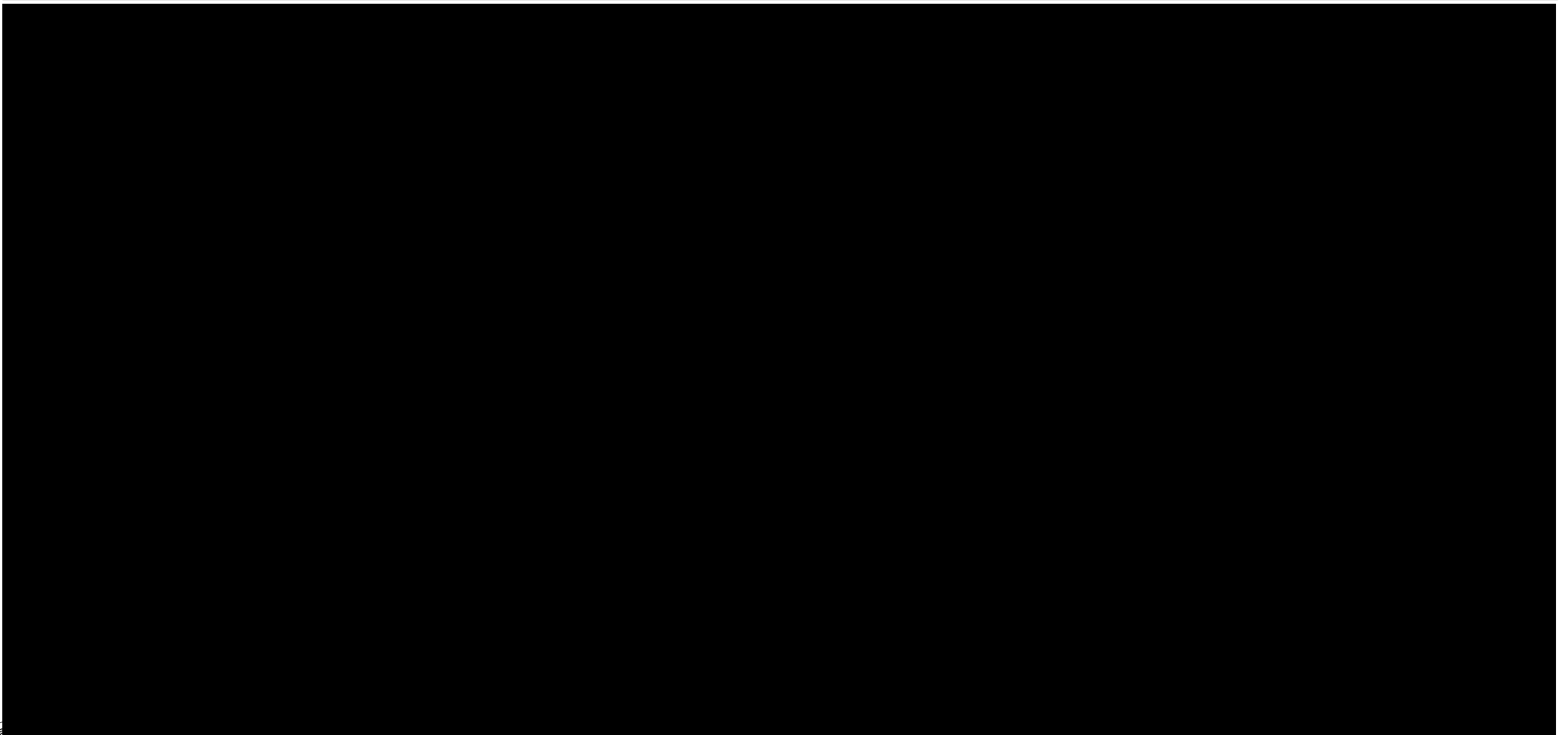


Sunlight provides the strongest light source. When it goes down at night, there are a variety of man-made lights that help drivers safely navigate the roads. Our eyes will adjust to lower levels of light (pupils dilate in darkness and constrict in brightness), but they have difficulty functioning properly when switching from bright to dark, or vice-versa.



IMPORTANCE OF LIGHTING

JAGUAR LAND ROVER LIGHTING



COMMUNICATION WITH LIGHTING - TODAY

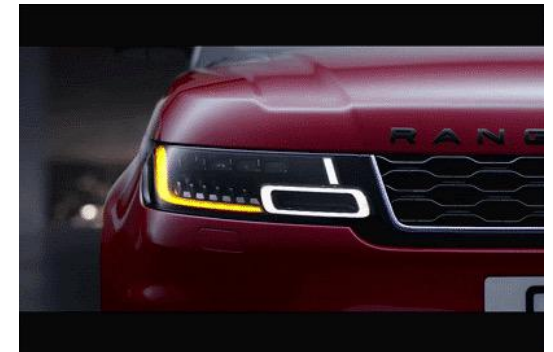


DRL – Enhanced visibility during the day to help reducing accidents by improving visual communication.

DI – Communicate intention of direction change, Stopped / broken down vehicle, or warning to other road users.

STOP LAMP – Communicate intention of stopping, slowing down or other obstruction or intention to reduce speed.

Reverse lamp– Communicate intention of vehicle reversing.



STATISTICS

NHSTA INFORMATION ON ACCIDENTS



Safety Facts

615,000

NUMBER OF MOTOR VEHICLE CRASHES THAT
COULD BE PREVENTED USING V2V
TECHNOLOGY

Safety Facts

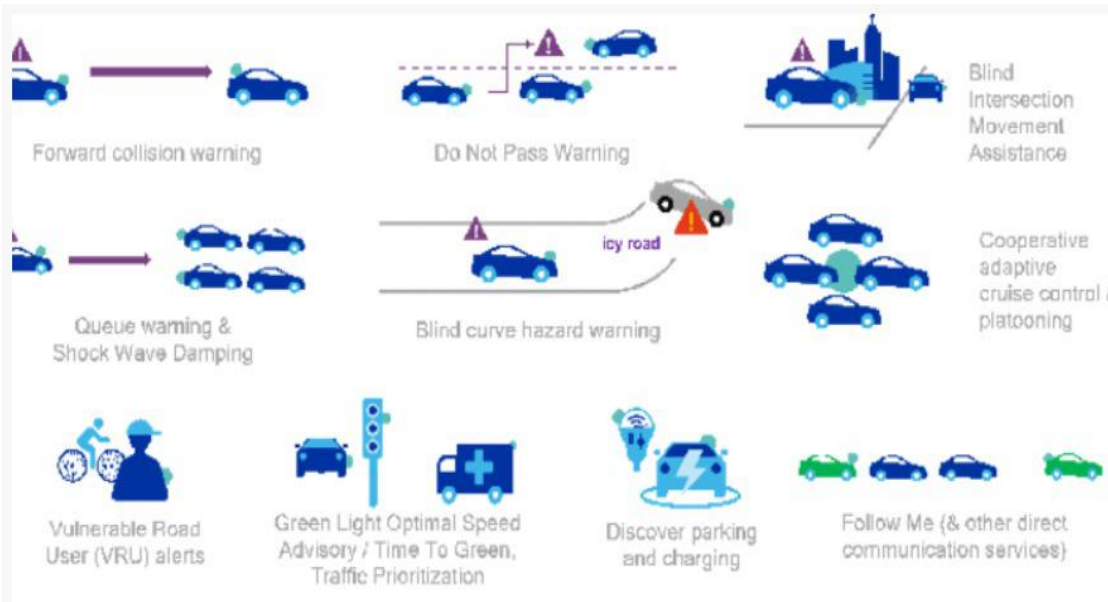
1,366

NUMBER OF LIVES THAT COULD BE SAVED
USING V2V TECHNOLOGY

According to NHTSA in 2017 there could have been over ½ million accidents avoided and over 1000 lives could have been saved if V2V connectivity was available and a staggering 20% of these could have been avoided with better / clear guidance intent was communicated at night



FUTURE OF LIGHTING



- Forward collision avoidance
- Do not overtake
- Queuing traffic
- Blind intersection
- Traffic build up avoidance – through V2X
- Blind curve
- Poor weather / road condition warnings



WHAT RESOLUTION DO WE NEED FOR IMAGE PROJECTION?



Standard Resolution $>1.5^\circ$ <100 Pixel ADB



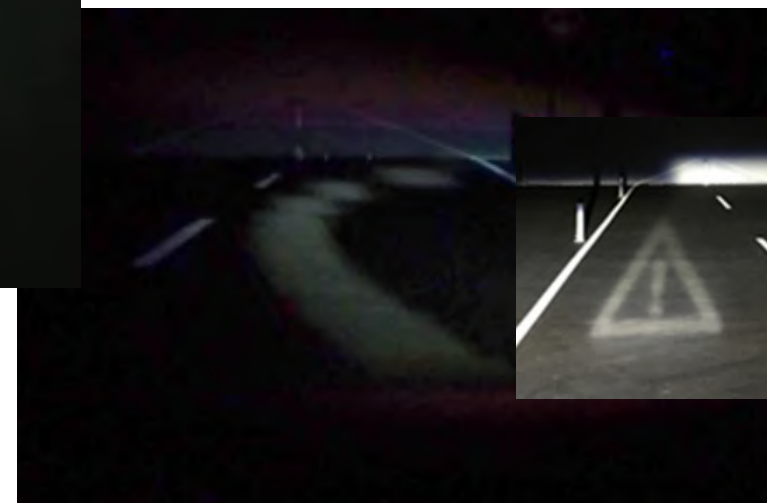
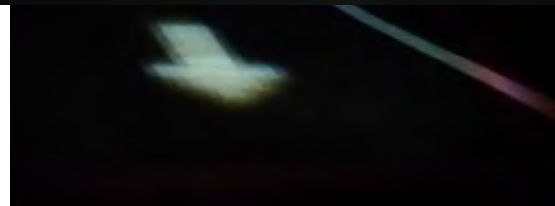
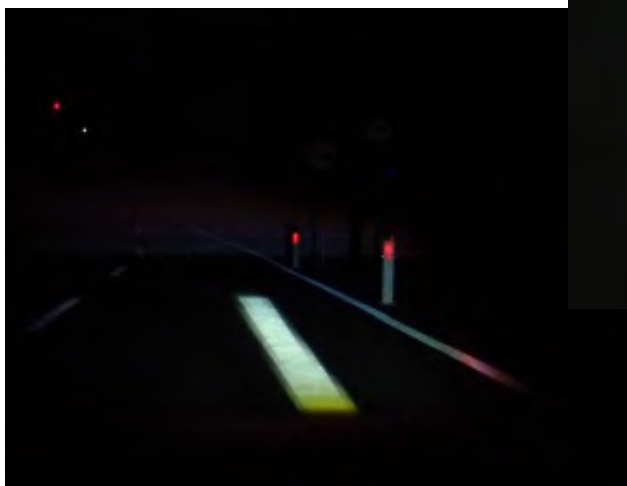
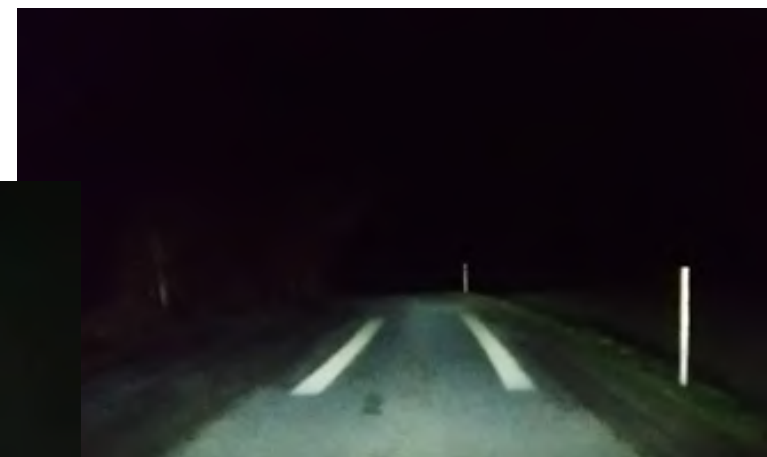
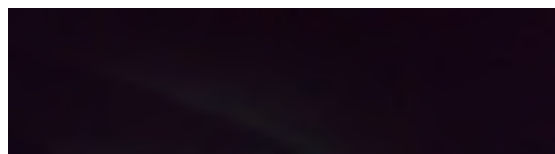
High Resolution $<0.1^\circ$ $>100,000$ Pixel ADB, object marking, symbol projection, cognitive driver support



Mid Resolution $0.5^\circ - 1^\circ$, $100 - 10,000$ Pixel ADB, object marking, Simple line projection



DMD vs <50000 PIXEL IMAGE RESOLUTION



BENEFITS OF USING LIGHTING FOR COMMUNICATION



- Increased pedestrian awareness.
- Peripheral compensation
 - If the indicator lights cease to function, projectors can assume indication function momentarily.
- Integration with emergency services.
 - E.g. Illumination of appropriate path to take to avoid impeding emergency services on duty.
- Projection of road surface and obstacles on rain droplets under poor weather conditions.
- Curb projection to outline poorly detectable surfaces.
- Map assistance that would allow drivers to keep their eyes on the road.
- Brake distance projection for high decelerations.



HOW DOES THIS HELP THE FUTURE AND OTHER ROAD USES



Zero Accidents / Zero Harm

- Positively influenced driver behaviour
- Heightened awareness for both pedestrians and drivers.

Zero Congestion / Reduce Pollution

- Map / destination projection will minimise risk of wrong turns.
- Reduce journey times
- Decreased risk of accidents



LIGHTING FOR ENHANCED COMMUNICATION

REAR LIGHTING TO COMMUNICATE DRIVING STATE



Display driving status to other road users

- Acceleration
- Deceleration
- Constant Speed



JRL EXTERIOR LIGHTING VISION



Exterior lighting of a vehicle is not just to see where you are going - but is also to be seen. This helps increase awareness on the road and reduce unwanted accidents.

Shammika Wickramasinghe
Jaguar Land Rover

HOW WE CAN IMPROVE SAFETY THE FUTURE



THANK YOU

