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Response to NTSB 2018 Pedestrian Safety Report

By Soft Lights Foundation

The National Transportation Safety Board released a Special Investigation Report in 2018 titled Pedestrian Safety[1]. Pedestrian safety is often ignored in the design process of transportation corridors and vehicle design, so this is a welcome report. However, the report fails to distinguish between lighting systems with spherical emitters such as tungsten filament and High-Pressure Sodium, and the far more dangerous flat surface emitters such as LED. This Response identifies the problems in the report related to lighting and LEDs.

Section 1.1, Table 2, Page 4

Table 2 shows fatality crashes by year and lighting condition. The table heading of "Dark" is a misnomer, as darkness has all but disappeared in urban settings. The use of LED streetlights, LED floodlights, LED vehicle headlights, LED billboards, and other light sources has essentially eliminated the category of "Dark". Therefore, this table provides data that is of little use because it doesn't categorize the ambient lighting situation at the time of the accident.

Table 2. Pedestrian fatalities by lighting condition (2007–2016).

Year	Total Fatalities	Fatalities by Lighting Condition					
		Daylight		Dusk	Dawn	Dark	
		Number	% of Total			Number	% of Total
2007	4,699	1,322	28.1	98	69	3,179	67.7
2008	4,414	1,145	25.9	101	88	3,059	69.3
2009	4,109	1,079	26.3	87	75	2,846	69.3
2010	4,299	1,092	25.4	80	81	3,030	70.5
2011	4,457	1,068	23.9	103	59	3,204	71.9
2012	4,818	1,168	24.2	101	76	3,452	71.6
2013	4,779	1,166	24.4	102	79	3,405	71.2
2014	4,910	1,191	24.3	97	88	3,510	71.5
2015	5,495	1,245	22.7	104	84	4,041	73.5
2016	5,987	1,290	21.5	124	81	4,453	74.4

[1] https://www.ntsb.gov/safety/safety-studies/Documents/SIR1803.pdf

Figure 1 shows LED streetlighting in an urban setting where darkness no longer exists.

Figure 1 – Urban Light[2]

Section 2.2.1 Past, Page 9

Quote: "*(such as the red flashing lights that require other vehicles to stop when a school bus is loading or unloading schoolchildren).*" – The crash referred to in this section occurred in 1996, so the red flashing lights would not have been LED. The red flashing lights would have had a slow ramp up and decay time, uniform illumination, and low luminance. The red flashing light would have served as a warning. Today's red LED flashing lights are nearly instant on/off, exceedingly high peak luminance, and non-uniform spatial shape that functions as an assault weapon, rather than a warning. In addition, where a school bus may have had two red flashing lights on the rear in the past, buses or emergency vehicles may now have many more LED flashing lights, overwhelming the driver. This video is an example of LED flashing lights on a fire truck: https://youtu.be/910_J5xhrTk

A study by the Emergency Responder Safety Institute concluded that LED flashing lights are dangerous.[3] NHTSA has no regulations for LED flashing lights and the NTSB is not currently reporting on the impacts of LED flashing lights on driver and pedestrian safety.

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[2] https://nj.pseg.com/businessandcontractorservices/outdoorlightingunmeteredservices/lightingoptions/securityroadwaylighting

[3] https://www.respondersafety.com/Download.aspx?DownloadId=f31a5f73-7b95-44c7-bd25-1e4cdfce5229

Figure 2 - LED Flashing Lights

Section 4.1.1 Vehicle Headlight Performance, Page 18

Quote: "*In 2016, a total of 4,453 pedestrians were killed during the hours of darkness, compared with 1,290 in daylight.*" – The wording "hours of darkness" cannot be used without context. In an urban environment such as New York City, darkness is almost nonexistent.

Quote: "*The NTSB investigations also show that crashes are more likely in darkness, with 9 of the 15 occurring outside daylight hours*" – The conclusion that crashes are more likely in darkness cannot be made here because the data only reference the time, not the ambient lighting conditions.

Quote: "*The annual number of fatal pedestrian crashes in darkness is sufficiently large to suggest that lighting countermeasures have the potential to prevent a substantial number of pedestrian fatalities."* – The suggestion of lighting countermeasures is exceedingly dangerous. Artificial light at night has been well documented to cause large increases in risk of cancers, premature births, and mood disorders.[4] The data does not support the concept of turning night into day to decrease pedestrian fatalities.

Quote: "*The most feasible approach to improving lighting is to improve headlights on cars so drivers can better see and avoid pedestrians.*" – We disagree with this statement. LED light from gas stations, floodlights, streetlights, flashing lights, and other sources that impair driver vision can easily be turned off and would greatly improve lighting conditions by reducing contrast and glare. Figure 3 shows the glare from LED gas station lights that impact driver vision.

[4] http://www.softlights.org/human-health/

Figure 3 - Gas Station[5]

Quote: "*However, the [FMVSS-108] standard does not include minimum illumination distance or on-vehicle performance testing of lighting systems. Rather, manufacturers self-certify that their lights meet the criteria for bulb output, using the results of component (or bench) tests (operating tests carried out on parts that have been removed from a vehicle). The standard, written in the 1960s, dates from a time when lamp bulbs were more homogeneous than now.*" – We strongly agree with this paragraph, although there is more to be said.

FMVSS-108 was written in 1967 with the implied understanding that the light source is a spherical emitter with uniform spatial output such as a tungsten filament and/or gas-discharge. The standard also allows for lensing to focus the light. FMVSS-108 does not define "light", even though the standard uses the term. We infer that FMVSS-108 does not apply to x-rays, radio waves, or particle radiation. We also infer that FMVSS-108 does not apply to directed-energy beams such as from lasers and LEDs. FMVSS-108 therefore applies only to human-visible electromagnetic radiation with uniform spatial properties, a spectral power distribution like tungsten filament, and continuous, non-flashing, non-flickering, light.

The auto manufacturers have been falsely self-certifying LED headlights as compliant with FMVSS-108 when they are not. As noted in the NTSB report, this idea of allowing auto makers to self-certify their headlight systems on a bench based on a standard written in the 1960s is no longer acceptable. The vehicle manufacturers are currently using measurement techniques and software that are not valid for LED headlight systems. The NHTSA FMVSS-108 testing procedures specify measuring the headlight output at 100 feet. This will never produce valid results for LED systems. To measure the peak luminance of LED light, a precision laboratory is needed, and the output must be measured in near field, at approximately 1 micrometer from the LED chip. Precision should be to the femtometer scale. The auto manufacturers, by continuing to use measurement devices designed for spherical emitters and by failing to use chip-maker precision data, are

[5] http://lossofthenight.blogspot.com/2014/04/

certifying their LED headlight systems as meeting the luminous intensity maximums, when in fact this is not true.

Figure 4 shows the blinding blue/white glare of LED headlights. The video accurately shows the dangerous glare caused by LED headlights: https://youtu.be/sQHpikG7UhA Note the soft, non-blinding, uniform lighting of the headlights of the vehicle from which the video was taken. It cannot be said that LED headlights are an improvement over tungsten/halogen. In fact, LED headlights are a major step backwards for safety.

Figure 4 - LED Headlight Glare

Quote: "*The Insurance Institute for Highway Safety uses factory-delivered models without adjusting headlight aim.*" – The IIHS fails to recognize the difference between LED headlights and other headlight systems and IIHS uses invalid measurement devices for LED headlight systems. The data collected by IIHS for LED headlights is unusable.

Quote: "*Vehicles are run on a test track while engineers measure how far vehicle lighting extends with an intensity of 5 lux for five path conditions: straight, curve left, curve right (those three are measured at a radius of 800 feet), sharp curve left, and sharp curve right (both are measured at a radius of 500 feet)"* – The use of a test track does not provide real world conditions. The IIHS typically ignores the light from oncoming vehicles, gas-stations, LED floodlights, LED streetlights and LED flashing lights. To provide useful data, the IIHS would need to simulate the differences between rural and urban driving.

Quote: "*The NTSB concludes that vehicle headlight systems require an evaluation that is more advanced than bench testing of bulb output. The NTSB therefore recommends that NHTSA revise FMVSS 108 to include performance-based standards for vehicle headlight systems correctly aimed on the road and tested on-vehicle to account for headlight height and lighting performance.*" – We completely agree with these statements, although the NTSB report is insufficient in its recommendations due to not adequately addressing LED light beams.

Quote: "*In response to public complaints about headlight glare, NHTSA conducted a series of studies on headlight factors and driver performance*" – NHTSA is still relying on this 2008 report[6], even though the 2008 report did not investigate LED headlights. NHTSA falsely claims that the 2008 report is "technology neutral", an impossibility given the differences between spherical and flat surface emitters. NHTSA's insistence on applying the 2008 study results to LED headlights has led to invalid conclusions by NHTSA. The 2008 glare report cannot be applied in any way to LED headlights.

Quote: "*One solution for reducing glare is to install adaptive lights that automatically adjust their intensity based on ambient street lighting or nearby cars*." – NHTSA has studied Adaptive Driving Beam and concluded that the system does not work[7][8], except perhaps on a rural, straight road. NHTSA found that ADB fails to meet many performance criteria. Despite this, NHTSA Acting Director Steven Cliff authorized ADB systems on February 1, 2022. The ADB authorization will allow headlights to blind people for 1/10 of a second before switching, does not address the issue of peak luminance, does not address the issue of glare from 450nm blue wavelength light, and does not address the issue of dozens or hundreds of vehicles dimming and brightening their headlights at the same time.

Quote: "*The NTSB concludes that motor vehicle safety standards should not limit advanced vehicle lighting systems that have been shown to have safety benefits. The NTSB therefore recommends that NHTSA revise FMVSS 108 to allow adaptive headlight systems*." – The NTSB's recommendation to allow ADB is dangerous. NHTSA has not studied the effects of LED lighting on people with epilepsy, autism, migraines, the elderly, babies, or children. NHTSA has not approved flat surface LED emitters for use as a vehicle headlight, so the ADB system would be an extra system on top of unauthorized LED headlights. NHTSA has no regulations for peak luminance, absolute spectral power distribution or flicker. The idea of allowing an ADB system without first studying the impacts of LED headlights is unacceptable.

Section 6.1 New Recommendations

Quote: "*Revise Federal Motor Vehicle Safety Standard 108 to include performance-based standards for vehicle headlight systems correctly aimed on the road and tested on-vehicle to account for headlight height and lighting performance. (H-18-39)*" – We agree, so long as the revision includes precise details about LED light beams.

Quote: "*Revise Federal Motor Vehicle Safety Standard 108 to allow adaptive headlight systems. (H-18-40)*" – We do not agree. ADB systems do not meet performance criteria, and ADB systems do not solve the problems of peak luminance, blue wavelength glare, or flicker.

February 17, 2022

[6] https://www.nhtsa.gov/sites/nhtsa.gov/files/811043.pdf
[7] https://www.nhtsa.gov/sites/nhtsa.gov/files/812174_lightingadb.pdf
[8] https://www.nhtsa.gov/DOT/NHTSA/NVS/Public%20Meetings/SAE/2016/P135968%20SAE%20_Mazzae%20ADB.pdf