

February 28, 2022

**BY EMAIL**

Craig Glidden, General Counsel  
General Motors  
craig.glidden@gm.com

**Re: LED Flashing Lights**

Dear Craig Glidden,

CEO Mary Barra's profile states, *"Under Barra's leadership, GM envisions a world with zero crashes, to save lives."*<sup>1</sup> It is sadly impossible to achieve Ms. Barra's goal when GM sells vehicles with toxic, hazardous, discriminatory, and illegal LED headlights. Below we explain that NHTSA has never approved a flat surface light source for use as a vehicle headlight and how GM is liable for selling vehicles with illegal headlights.

## Eye Damage

### Warnings

Shown below are the warning labels for several LED products, alerting the operator that LEDs can cause momentary blindness, eye damage, and vision loss, even at a distance. GM uses similar LED devices in their car and truck headlights that are pointed directly or nearly directly into the eyes of babies, children, adults, the elderly, and wildlife.

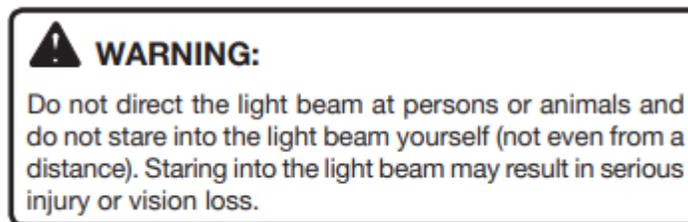


Figure 1 - Ryobi LED Warning

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<sup>1</sup> <https://www.gm.com/company/leadership/corporate-officers>

**WARNING:** To avoid eye injury, do not stare directly into the light beam or shine the beam directly into anyone's eyes. This product is not designed, intended, or recommended for children or hazardous environments.

Figure 2 - GearLight LED Warning

**IMPORTANT WARNING!**  
**CAUTION! DO NOT LOOK DIRECTLY AT THESE LED'S WHILE THEY ARE ON. MOMENTARY BLINDNESS AND/OR EYE DAMAGE COULD RESULT!**

Figure 3 - Whelen Engineering LED Warning<sup>2</sup>

**Do not look directly into the light.**

Figure 4 - Feit Electric LED Warning<sup>3</sup>

**CAUTION**

To prevent eye damage,  
avoid looking directly at the  
unshielded LEDs.

Figure 5 - Hydrobuilder LED Warning<sup>4</sup>

- Avoid direct eye exposure to the light source while it is on.

Figure 6 - Acuity Brands LED<sup>5</sup>

We reviewed the Owner's Manual for the 2022 Chevrolet Traverse.<sup>6</sup> Figure 7 is information about the Automatic Dimming Mirror system, noting that the mirrors will dim to adjust for glare. What

<sup>2</sup> <https://www.whelen.com/wp-content/uploads/2020/08/14555.pdf>

<sup>3</sup> [https://www.feit.com/wp-content/uploads/2019/09/LEDR56FP\\_927\\_MANUAL.pdf](https://www.feit.com/wp-content/uploads/2019/09/LEDR56FP_927_MANUAL.pdf)

<sup>4</sup> <https://hydrobuilder.com/media/pdf/instructions/ROI-E720-user-manual.pdf>

<sup>5</sup> [https://img.acuitybrands.com/public-assets/catalog/753016/epanl-instruction-sheet.pdf?abl\\_version=12%2f06%2f2021+12:23:30&DOC\\_Type=Installation\\_Instruction\\_Sheets](https://img.acuitybrands.com/public-assets/catalog/753016/epanl-instruction-sheet.pdf?abl_version=12%2f06%2f2021+12:23:30&DOC_Type=Installation_Instruction_Sheets)

<sup>6</sup> [https://www.chevrolet.com/bypass/pcf/gma-content-api/resources/sites/GMA/content/staging/MANUALS/5000/MA5555/en\\_US/4.0/22\\_CHEV\\_Traverse\\_OM\\_en\\_US\\_U\\_84742925B\\_2021NOV17\\_2P\\_INS1.pdf](https://www.chevrolet.com/bypass/pcf/gma-content-api/resources/sites/GMA/content/staging/MANUALS/5000/MA5555/en_US/4.0/22_CHEV_Traverse_OM_en_US_U_84742925B_2021NOV17_2P_INS1.pdf)

is missing, though, is the warning that this glare is caused by GM’s LED headlights and that GM’s headlights will cause temporary blindness, loss of vision, and eye damage to oncoming drivers and pedestrians.

**Automatic Dimming Mirror**  
The vehicle has an automatic dimming outside mirror on the driver side. The mirror will adjust for the glare of headlamps behind you.

Figure 7 – GM Auto Dim Mirror for Glare<sup>7</sup>

Figure 8 warns the operator not to replace incandescent bulbs with aftermarket LED bulbs due to possible electrical damage to the vehicle system. The caution does not explain that NHTSA has never approved any aftermarket LED headlights, nor OEM LED headlights.

**Caution**  
Do not replace incandescent bulbs with aftermarket LED replacement bulbs. This can cause damage to the vehicle electrical system.

Figure 8 – GM LED Caution

Figure 9 is the Features information about the GM Traverse.<sup>8</sup> Note that GM admits that LED headlamps are a “bright, intense beam”. Flat surface LED light is indeed a bright, intense non-uniform energy beam that is toxic, hazardous, discriminatory, and illegal, and yet GM chooses to promote these types of headlamps.

**LED** headlamps 

- Provide a bright, intense beam of light to illuminate the road ahead
- Help improve down-the-road visibility in low-light conditions
- Include LED D-optic bi-function projector technology

Figure 9 - GM Traverse LED Headlight Feature

<sup>8</sup> <https://www.chevrolet.com/suvs/traverse/build-and-price/features/trims/table>

A search of the 385-page Chevrolet Traverse owner’s manual showed that the word “warning” was used 391 times, or more than once per page. GM certainly seems concerned about alerting operators to safety issues. Yet, we saw no warning in the entire user manual that details the momentary blindness, loss of vision, eye damage, or psychological assault caused by GM’s use of LED headlamps, even though other manufacturers have issued these warnings about their products that use LEDs. Does GM claim that their LED headlight systems do not cause loss of vision, do not cause eye damage, do not cause momentary blindness, and do not cause psychological trauma? Does GM disagree with the warnings from other manufacturers that use LEDs?

### Medical Research

Ophthalmologists have reported that their patients are reporting glare and double vision from LED headlights.<sup>9</sup> A quote from the news article states, “*Increasingly, ophthalmologists are getting complaints from patients about glare from LED (light emitting diode) bulbs commonly being used as headlights in vehicles.*” Note that the article states that these complaints are increasing.

The information in Figure 10 states that “retinal damage can occur when the eye is exposed to high luminance.”

**Health effects** [\[ edit \]](#)

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*Further information: Laser safety*

Retinal damage can occur when the eye is exposed to high luminance. Damage can occur because of local heating of the retina. Photochemical effects can also cause damage, especially at short wavelengths.

Figure 10 - High Luminance Causes Retinal Damage<sup>10</sup>

As of 2013, Hella’s LED headlights had reached peak luminance of 70,000,000 candela / m<sup>2</sup>, as shown in Figure 11. As per the chart in Figure 12, the maximum visual tolerance is 50,000 candela / m<sup>2</sup>.

### 3 LED HEADLIGHTS ADVANTAGES: COMPARISON

LEDs are superior in several aspects. They might be more expensive to purchase than normal light bulbs or halogen bulbs, but their use pays for itself in a short time. The automotive industry in particular uses the positive features of the LED and employs it increasingly in new vehicles due to the following advantages:

Light Source	Luminous flux [lm]	Efficiency [lm/W]	Colour temperature [K]	Luminance [Mcd/m <sup>2</sup> ]
Conventional bulb W5W	~ 50	~ 8	~ 2700	~ 5
Halogen bulb H7	~ 1100	~ 25	~ 3200	~ 30
Gas discharge D2S	~ 3200	~ 90	~ 4000	~ 90
LED 2.5 Watts	~ 120 (2010) ~ 175 (2013)	~ 50 (2010) ~ 70 (2013)	~ 6500	~ 45 (2010) ~ 70 (2013)

Figure 11 - Headlight Luminance<sup>11</sup>

<sup>9</sup> <https://outline.com/yxTUzE>

<sup>10</sup> <https://en.wikipedia.org/wiki/Luminance>

<sup>11</sup> Hella - <https://www.hella.com/techworld/us/Technical/Automotive-lighting/LED-headlights-833/>

### 3.2 Typical Values of Luminance

Light Source	Luminance, candela per square metre
Sun	$1.6 \times 10^9$
Arc lamp	$1.5 \times 10^8$
Metal halide lamp	$5.3 \times 10^6$
Clear incandescent lamp, filament	$2 \times 10^6$ to $2 \times 10^7$
Frosted incandescent lamp	50000 to 400000
Low pressure sodium lamp	75000
Maximum visual tolerance	50000
Cloud (sunny day)	35000
Fluorescent lamp	12000 to 14000
White illuminated cloud	10000
60 watt soft-white bulb	10000
Surface of moon	1000
Metal-halide flood lamp	500
Convenience store sign	150
White paper under lamp	30 to 50
Television screen (CRT)	9
Neon lamp	8
Candle	7.5
Clear sky	3 to 5
Moon	2.5
White paper lit by candle at one foot	0.29
Dark sky reserve (proposed)	0.1
Night sky	0.001
Threshold of vision	0.000003

Sources: [32], [7]

Figure 12 - Point Source and Reflected Light Luminances<sup>12</sup>

The research article What is a Photobiological Safety Standard?<sup>13</sup> Is a discussion of IEC 62471 and concern about eye damage from LEDs and the classification groups Risk Group 0, 1, 2 and 3. We see no indication on GM's website that GM has addressed the issue of photobiological safety when exposed to GM LED headlights. What is the amount of thermal and chemical eye damage caused by exposure to GM's LED headlights and how does this damage accumulate over time?

GM's failure to prominently notify the public of the dangers of exposure to GM LED headlights is a liability for GM. We have posted links to additional research articles on this topic on our website.<sup>14</sup>

## LED Glare

<sup>12</sup> [https://www.atecorp.com/atecorp/media/pdfs/data-sheets/tektronix-j16\\_application.pdf](https://www.atecorp.com/atecorp/media/pdfs/data-sheets/tektronix-j16_application.pdf)

<sup>13</sup> <https://fireflier.com/what-is-photobiological-safety-standard/>

<sup>14</sup> <http://www.softlights.org/human-health/>

The gm.com website has a video promoting GM's switch to electric vehicles. The video prominently shows the GM electric vehicle using the same LED lighting systems that other manufacturers have placed labels on, warning about momentary blindness, eye damage, and vision loss, and warning users not to shine these lights directly into the eyes of a person. Yet, GM's video clearly and prominently shows the LED headlights and LED lightbar shining directly into the eyes of the viewer, including advertising of the vehicle's name.



*Figure 13 - 2022 GM Electric Truck<sup>15</sup>*

Figure 14 shows the blinding glare from an LED light on the front of the GMC Hummer EV.



*Figure 14 - GM Electric Truck Toxic Light*

Figure 15 shows the electric Chevrolet Silverado with blindingly bright lights. The harsh white strip with the Chevrolet logo clearly shows that Chevrolet is not worried about ensuring that their vehicles are not a distraction. Chevrolet seems far more interested in style than safety. What purpose does all this LED light serve, other than to distract, cause eye injury, and to discriminate against those who are LED-sensitive?



*Figure 15 - Chevrolet Silverado Electric*

We did not see any warning on the video from GM notifying owners that they should not shine these LED headlights directly into anyone's eyes. We did not find any warnings on GM's website notifying the public that GM LED headlights cause eye damage.

Consider the photo of tungsten filament headlights as shown in Figure 16. The photo shows the yellowish color and low glare of the tungsten headlights providing sufficient illumination for the driver, without blinding the oncoming bear, deer, driver, or pedestrian with dangerous glare and excessive luminance.



Figure 16 - Tungsten Filament Headlights<sup>16</sup>

On the other hand, Figure 17 is an example of the glare from the type of LED headlights that GM uses in their vehicles. Here is a link to a video showing the oncoming glare from different vehicles. Video: <https://youtu.be/sQHpkG7UhA>



Figure 17 - LED Headlight Glare

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<sup>16</sup> <https://www.usautosales.info/blog/pros-and-cons-of-halogen-and-led-headlights/>

As can be seen in the Figure 17 photo and video, the roadway in front of the vehicle taking the video is well lit with the soft, yellow color of a tungsten filament headlight, with the entire lane filled with light, and additional light outside of the lane. While these point source lights may be bright, they do not impact the oncoming driver in nearly the same dangerous fashion as the blue/white flat surface LED headlights from the oncoming vehicle. The three major features of LED headlights that make them so dangerous are the non-uniform energy caused by the flat surface source, the 70,000,000 candela / m<sup>2</sup> peak luminance that is nearly invariant over distance, and the excessive amount of high energy, glare-causing blue wavelength light. Not visible in the photo may also be sensory or sub-sensory flicker.

## Point Source versus Flat Surface Source

With the invention of lasers and LEDs, there are now two types of light sources. There are point sources and flat surface sources. The science and art of lighting that has developed over the past centuries is based solely on point sources of light. The invention of flat surface light sources requires an entirely new understanding of how flat surface light functions; this understanding is missing at GM.

A point source, which may also be called a spherical emitter or spatially uniform emitter, exists when the energy from the light source radiates uniformly in all 3D spatial directions. The brightness of the light is approximated by luminous intensity, measured in candela.

A flat surface source, also called a Lambertian source or LED source, only emits light in the forward direction from a non-curved surface, resulting in a non-uniform (Lambertian) shape. The brightness of this type of light is approximated by peak luminance, measured in candela per square meter, also known as nits.

The difference between a point source and a flat surface source is well known within the LED display industry, but entirely lacking within the LED illumination and auto industry. Figure 18 differentiates the two light source types.

## **Brightness and linearity of human vision**

- **Brightness: lack of standardized scientific definition**
  - **Brightness is an attribute of visual perception and is frequently used as synonym for luminance and (incorrectly) for the radiometric term radiance**
- **For point source,**
  - **Brightness (in the photopic vision regime) can be approximated by the luminous intensity (cd)**
- **For surface source,**
  - **Brightness can be approximated by luminance (cd/m<sup>2</sup>)**
- **Standard CIE**
  - **Assumption: human vision is linear within the photopic regime**
  - **Isotropically emitting blue point source and red point source have the same luminous intensity**

445.664 (Intro. LED) / Euijoon Yoon

Figure 18 – Brightness of Two Source Types<sup>17</sup>

Figure 19 is another observation that measuring the brightness of light from a point source is different than measuring light from a flat surface source. LEDs are flat surface sources, not point sources, and must be measured by luminance, not luminous intensity.

To quantify the brightness of a source, it is useful to differentiate between point and surface area sources. For *point sources*, brightness (in the photopic vision regime) can be approximated by the luminous intensity (measured in cd). For *surface sources*, brightness (in the photopic vision regime) can be approximated by the luminance (measured in cd/m<sup>2</sup>). However, due to the lack of a formal standardized definition of the term brightness, it is frequently avoided in technical publications.

Figure 19 - Quantifying Brightness of a Source<sup>18</sup>

Figure 20 uses the words “Lambertian source” rather than “flat surface source” because the mathematical shape of light from a flat surface follows Lambert’s Cosine Law.

<sup>17</sup> Seoul National University - <https://ocw.snu.ac.kr/sites/default/files/NOTE/791.pdf>

<sup>18</sup> Rensselaer Polytechnic Institute, School of Engineering - <https://www.ecse.rpi.edu/~schubert/Light-Emitting-Diodes-dot-org/Sample-Chapter.pdf>

*Lambertian Source: A Lambertian source only radiates in one half of the full three-dimensional space, and whose intensity (per unit area of source) varies as the cosine of the angle from maximum output (which is perpendicular to the surface) [76].*

Figure 20 - Lambertian Source Definition<sup>19</sup>

Figure 21 is further confirmation that LEDs are not point sources, but instead have a non-uniform shape called a Lambertian.

**Historically, many LED sources have had nearly Lambertian beam distributions**

Figure 21 - LEDs Approximate Lambertians<sup>20</sup>

Figure 22 discusses the mathematics of the Lambertian distribution from a flat surface emitter.

Eq. (6) is of the form  $\rho = b \cos(\phi)$  in  $(\rho, \phi)$  polar coordinates where  $b$  is a constant [14]. Eq. (1) and Eq. (6) are known as the *Lambertian* distribution, which represents the 3D light intensity distribution from a flat, differential-area emitter.

Figure 22 - A Flat Surface Emitter is a Lambertian<sup>21</sup>

There are thus two types of light sources. There are point sources, where the emitted energy is uniform in all spherical directions, and the brightness is measured via the luminous intensity metric, and there are flat surface sources, where the emitted energy is non-uniform, has a Lambertian shape, and the brightness is measured via the luminance metric. The two types of light sources are very different and cannot use the same standards or mathematical equations.

It is unclear whether GM has failed to recognize the difference between these two types of light sources, or whether GM has simply chosen to ignore the differences. Either way, the result is the sale of vehicles with dangerous flat surface LED headlights that do not comply with NHTSA FMVSS-108, and which cause momentary blindness, loss of vision, eye damage, psychological trauma, distraction, and vehicle crashes.

<sup>19</sup> University of Capetown - [https://www.crses.sun.ac.za/files/research/completed-research/other/r\\_solomon.pdf](https://www.crses.sun.ac.za/files/research/completed-research/other/r_solomon.pdf)

<sup>20</sup> University of Washington - <https://depts.washington.edu/mictech/optics/me557/Radiometry.pdf>

<sup>21</sup> <https://ieeexplore.ieee.org/document/8879542>

## LED Headlight Dangers

Figure 23 is a table from Hella showing supposed advantages of LED headlights. The last column lists the peak luminance of an LED headlight in Mcd/m<sup>2</sup>. The capital M stands for millions, so 70 means that Hella headlights had a peak luminance of 70,000,000 candela per square meter in 2013. We know that by 2018, LED chip makers had reached 100,000,000 candela per square meter.<sup>22</sup>

### 3 LED HEADLIGHTS ADVANTAGES: COMPARISON

LEDs are superior in several aspects. They might be more expensive to purchase than normal light bulbs or halogen bulbs, but their use pays for itself in a short time. The automotive industry in particular uses the positive features of the LED and employs it increasingly in new vehicles due to the following advantages:

Light Source	Luminous flux [lm]	Efficiency [lm/W]	Colour temperature [K]	Luminance [Mcd/m <sup>2</sup> ]
Conventional bulb W5W	~ 50	~ 8	~ 2700	~ 5
Halogen bulb H7	~ 1100	~ 25	~ 3200	~ 30
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LED 2.5 Watts	~ 120 (2010) ~ 175 (2013)	~ 50 (2010) ~ 70 (2013)	~ 6500	~ 45 (2010) ~ 70 (2013)

Figure 23 - Headlight Luminance<sup>23</sup>

Figure 23 also shows that conventional headlights were on the order of 5,000,000 candela / m<sup>2</sup>. However, the chart does not specify the distance at which the 5,000,000 candela / m<sup>2</sup> was measured. Since distance is a vital value when measuring luminance<sup>24</sup>, it would seem to be impossible to make a comparison of the luminance of a conventional bulb with an LED from this table. The key point with flat surface LED light is that the 70,000,000 candela / m<sup>2</sup> luminance will be same regardless of distance, versus the 5,000,000 candela / m<sup>2</sup> that would only be valid at a given distance and would then decrease with distance.

As a reminder, the maximum human tolerance is 50,000 candela / m<sup>2</sup>, so both conventional lights and LED lights far exceed maximum human tolerance, and we cannot look directly at the light. The purpose of a light source is to illuminate objects which gives rise to vision. When light sources emit light directly into the eye, vision is reduced. The use of a 70,000,000 candela / m<sup>2</sup> luminance non-uniform light source which is invariant over distance, and which is 14 times brighter than a conventional headlight and which is 1,400 times brighter than human tolerance is negligence.

There are several differences between conventional headlights and LED headlights that make LED headlights toxic, hazardous, discriminatory, and illegal.

**Luminous intensity** is a measure of the wavelength-weighted power emitted by a light source in a particular direction per unit solid angle, based on the luminosity function, a standardized model of the

<sup>22</sup> <https://www.laserfocusworld.com/test-measurement/research/article/16555223/nonlaser-light-sources-highluminance-leds-target-emerging-automotive-lighting-applications>

<sup>23</sup> Hella - <https://www.hella.com/techworld/us/Technical/Automotive-lighting/LED-headlights-833/>

<sup>24</sup>

[https://www.researchgate.net/publication/275534163\\_The\\_Impact\\_of\\_Distance\\_on\\_the\\_Accuracy\\_of\\_Luminance\\_Measurement](https://www.researchgate.net/publication/275534163_The_Impact_of_Distance_on_the_Accuracy_of_Luminance_Measurement)

sensitivity of the human eye.<sup>25</sup> Luminous intensity is measured in candelas, where 1 candela is equal to the light power from 1 candle. A unit solid angle is equal to 1 steradian. There are  $4\pi$ , or about 12.6, steradians in a sphere. Therefore, luminous intensity is a measure of the power of the light through a solid angle and if the light source is uniform, then no matter what angle is selected, the luminous intensity will be the same. A luminous intensity of 70,000 candela means the light power from 70,000 candles traveling through a steradian.

As the light travels through space, the light spreads out following the inverse square law. At 1 micrometer, 1 meter, 100 meters, and 1 kilometer, the power of this light is diffused more and more, such that when the light lands on a surface, the total amount of light landing on the surface will be far greater at 1 micrometer than at 1 kilometer. Therefore, to know the total power landing on the eye, we must know the distance from the source.

Luminous intensity is used for point sources such as tungsten. It is not used for flat surface sources such as LED. Because GM uses luminous intensity while attempting to measure brightness for LEDs, GM is using the wrong metric.

**Luminance** is a photometric measure of the density of luminous intensity in a given direction. It describes the amount of light that passes through or is emitted from a particular area and falls within a given solid angle.<sup>26</sup> A density of 300 candela per square meter, which is typical of a computer display, means that the light power equates to 300 candles from 1 square meter of surface area. The surface area of the eye is about  $.00015\text{m}^2$ .<sup>[27]</sup> The area of an LED is  $.000001\text{m}^2$ , which is smaller than the human eye. The fact that the human eye is larger than the source of the light is significant because it means that the entire energy of the LED will land on the eye, as LED light is extremely dense, and this density will vary little over distance.

Luminance is well known in the display industry, and displays such as on cell phones, computer monitors, and electronic billboards properly specify the luminance in candela per square meter or nits to convey the brightness of the display. GM fails to alert the public to the luminance of its headlights so that the public can know how much eye damage is occurring when exposed to LED headlights, LED Daytime Running Lights, LED turn signals, and LED dashboards.

**Color Temperature** is an imperfect value that condenses the spectral power distribution into a single number. In the table of Figure 23, the conventional headlamp is rated at 2700 Kelvin, whereas the LED headlight is rated at 6500 Kelvin. The spectral power distribution for a tungsten headlamp is shown in Figure 24 and the spectral power distribution for a 6500K LED headlamp is shown in Figure 25. Glare is caused by blue wavelength light. As is shown in the diagrams, the LED headlamp has vastly more blue wavelength light, which greatly increases glare, loss of vision, risk of eye damage, and risk of psychological disturbances.

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<sup>25</sup> <https://www.convertworld.com/en/luminous-intensity/>

<sup>26</sup> <https://www.convertworld.com/en/luminance/>

<sup>27</sup> <https://iovs.arvojournals.org/article.aspx?articleid=2772477>

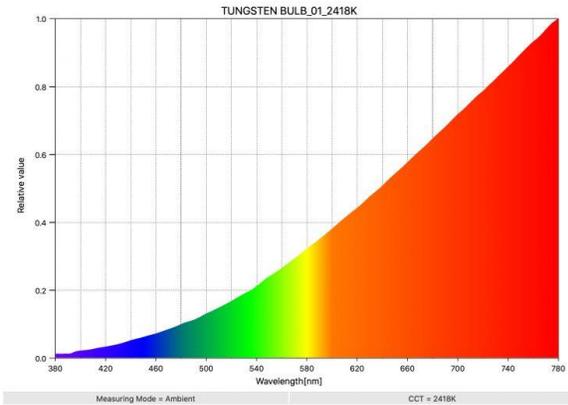


Figure 24 - Tungsten Spectral Power Distribution<sup>28</sup>

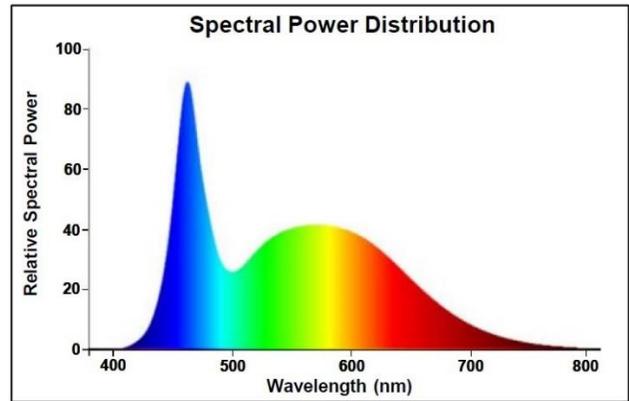


Figure 25 - Sylvania 6500K LED Spectral Power Distribution<sup>29</sup>

GM's use of high-glare LED headlights with excessive amounts blue wavelength puts drivers, passengers, pedestrians, and wildlife at risk of eye damage, loss of vision, distraction, agitation, anger, and vehicle crashes.

### Flicker

LED headlight systems often produce flicker due to use of Pulse Width Modulation or other engineering techniques. This video shows the flicker on a Toyota Prius. Video: <https://youtu.be/YYhhhG4XQtQ> This flicker was not present when GM used conventional tungsten point source headlights. Some people have enhanced senses that cause them to be able to consciously see the flicker. Whether consciously visible or not, LED flicker is associated with epileptic seizures, debilitating migraines, and other neurological reactions.

## Federal Laws

### Motor Vehicle Safety Act of 1966

Prior to 1966 in the USA, there were no vehicle safety regulations, and deaths from vehicle crashes were increasing dramatically. Ralph Nader led the effort to have Congress pass legislation prohibiting automakers from designing vehicles that put the public at risk of injury or death. Congress passed the Motor Vehicle Safety Act of 1966.<sup>30</sup>

The Motor Vehicle Safety Act defines motor vehicle safety: *“motor vehicle safety” means the performance of a motor vehicle or motor vehicle equipment in a way that protects the public against unreasonable risk of accidents occurring because of the design, construction, or performance of a motor vehicle, and against unreasonable risk of death or injury in an accident, and includes nonoperational safety of a motor vehicle.*<sup>31</sup>

<sup>28</sup> <https://www.newsshooter.com/2020/05/11/how-do-you-get-led-lights-to-play-well-together/>

<sup>29</sup> <https://www.sylvania-lighting.com/product/en-gb/products/0027102/>

<sup>30</sup> <https://www.govinfo.gov/content/pkg/STATUTE-80/pdf/STATUTE-80-Pg718.pdf#page=4>

<sup>31</sup> [https://www.law.cornell.edu/definitions/uscode.php?width=840&height=800&iframe=true&def\\_id=49-USC-1450788177-1380006377&term\\_occur=28&term\\_src=](https://www.law.cornell.edu/definitions/uscode.php?width=840&height=800&iframe=true&def_id=49-USC-1450788177-1380006377&term_occur=28&term_src=)

LED headlights and LED Daytime Running Lights are an obvious design flaw because of the non-uniform energy and Lambertian shape of the light, the spectral power distribution with large spike of blue wavelength light, and the LED flicker. These properties create an unreasonable risk of death or injury, so LED headlights do not meet the definition of motor vehicle safety. LED headlights violate the Motor Vehicle Safety Act.

GM's vehicles with LED headlights violate the Federal Motor Vehicle Safety Act because they are an inherently unsafe design that puts the public at unreasonable risk of death or injury. Just like the time prior to 1966, GM is once again focusing on style and selling flashy vehicles, rather than concerning itself with protecting the eyes and lives of the public.

### Americans with Disabilities Act

Because LED headlights trigger life-threatening epileptic seizures, migraines, panic attacks and other negative neurological reactions, LED headlights interfere with major life functions such as seeing, thinking, and concentrating. LED headlights prevent those with light sensitivity disabilities from accessing public services and from navigating to and from employment.

We see no indication on GM's website that GM engaged with the US Access Board to ensure that their LED headlights and Daytime Running Lights do not discriminate. We know that the US Access Board has failed to provide guidance to the industry, but the US Access Board's failure does not negate GM's requirement of selling vehicles that do not discriminate.

GM's vehicles with LED headlights and LED Daytime Running Lights violate the Americans with Disabilities Act.

## National Highway Transportation Safety Administration

### Federal Motor Vehicle Safety Standards

The National Highway Transportation Safety Administration was created by the Motor Vehicle Safety Act of 1966. One of the first things NHTSA did was to create the Federal Motor Vehicle Safety Standards. Section 108 details the standards for vehicle lighting.<sup>32</sup>

FMVSS-108 assumes that the light is from the human-visible part of the electromagnetic spectrum and that the light is from a point source. Microwave and x-ray portions of the electromagnetic spectrum are not covered by FMVSS-108, and flat surface sources such as light from an LED or laser beam are also not covered. This means that LED headlights do not comply with FMVSS-108 and are thus not approved for use in motor vehicles. NHTSA's failure to enforce FMVSS-108 does not relieve GM of its requirement to comply with FMVSS-108.

Figure 26 is a diagram from Hella, a major manufacturer of LED headlights for the auto industry. It is critical to note that these diagrams do not show the non-uniform spatial energy emitted by an LED. These diagrams give the false impression that the LED light is uniform when it is not. No matter how the

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<sup>32</sup> <https://www.law.cornell.edu/cfr/text/49/571.108>

LED light is reflected or refracted by the optics, the light will still emerge from the headlight with exceedingly intense energy that will far exceed NHTSA regulations for maximum luminous intensity.

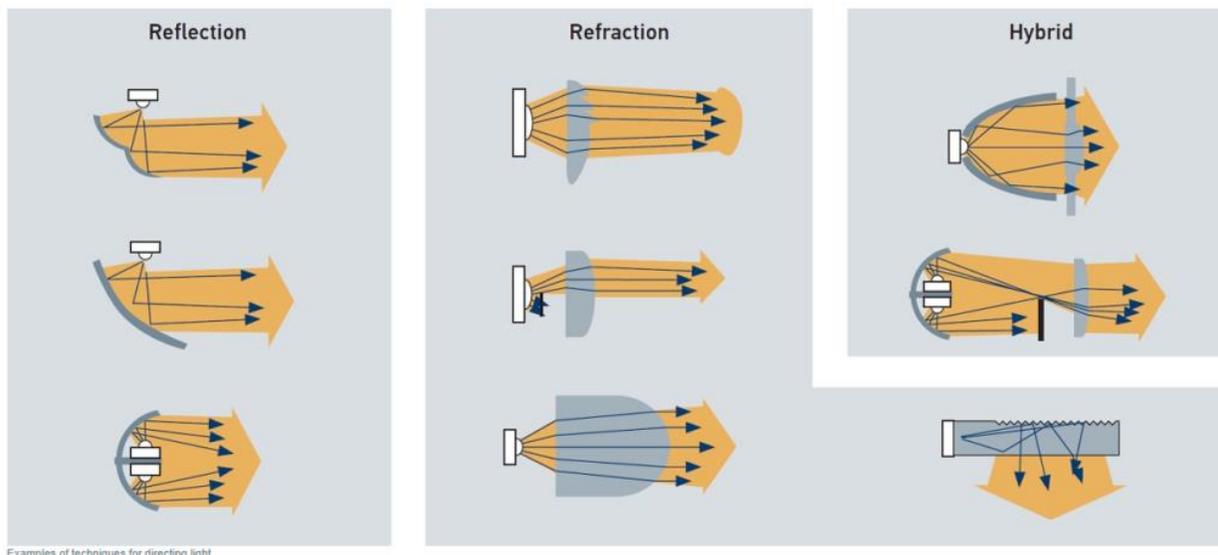


Figure 26 - Optics Diagram of LED Headlight

GM's use of federally unapproved LED headlights and LED Daytime Running Lights makes GM liable for the injuries and harm they cause.

### FMVSS-108 Certification

We are not privy to GM's procedures for self-certification of their headlight systems. However, we generally surmise that GM, or its vendors, place the headlight on a bench and follow the NHTSA test procedure which calls for measuring the luminous intensity at 100 feet from the headlight.<sup>33</sup> This testing procedure will produce invalid results for LED headlights because LED luminance must be measured in near field (approximately 1 micrometer) in a precision laboratory setting. Additional precision data must then be taken, and the luminous intensity can then be calculated.<sup>34</sup> In all probability, this data will show that LED headlights greatly exceed the luminous intensity maximums set in FMVSS-108.

It is exceedingly likely that GM's self-certification procedures for LED have resulted in the submission of false certification to NHTSA, both because the luminous intensity will exceed the maximums set in FMVSS-108, and because FMVSS-108 is only applicable to point light sources. GM must notify NHTSA that its test procedures for flat surface LED headlights are invalid.

### Adaptive Driving Beam

On February 22, 2022, NHTSA published the final rule for Adaptive Driving Beam headlights.<sup>35</sup> The final rule includes NHTSA's ADB study, which shows that ADB systems don't work. For example, ADB systems don't work on hills or when turning into parking lots. The ADB system does

<sup>33</sup> [https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/tp-108-13\\_tag.pdf](https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/tp-108-13_tag.pdf)

<sup>34</sup> <https://ieeexplore.ieee.org/document/8879542>

<sup>35</sup> NHTSA Federal Register - <https://www.federalregister.gov/documents/2022/02/22/2022-02451/federal-motor-vehicle-safety-standards-lamps-reflective-devices-and-associated-equipment-adaptive>

nothing to address the non-uniform, Lambertian shape of the LED light, the issue of the 70,000,000 nit peak luminance from LED chips, the use of 6500 Kelvin Correlated Color Temperature blue wavelength light, or the issue of LED flicker.

The ADB system that NHTSA supposedly approved is based on the use of flat surface LED headlight systems that have never been approved by NHTSA. The Soft Lights Foundation submitted a response to NHTSA's final rule on ADB to the Federal Register.<sup>36</sup> Therefore, an automaker that uses an ADB system with LED headlights will still have an unapproved, illegal headlight system. GM is liable for the injuries these systems cause.

### Crashes, Injuries, and Death

Traffic fatalities have been rising in lockstep with the auto industry's use of unapproved LED headlights. NHTSA's fatality crash report of February 2022 shows that fatality crashes increased 12% between 2020 and 2021.<sup>37</sup> While we understand that COVID-19 is possibly also a significant factor in fatality crashes for the past 2 years, the fact that fatality crashes started increasing just as LED headlights came into use, and the lack of study of the impacts of glare from LED headlights, LED Daytime Running Lights and LED flashing lights on emergency vehicles, makes it likely that LED headlights are a contributor to the approximately 40,000 American deaths each year from vehicle crashes.

GM is liable for a portion of these injuries and deaths due to GM's use of unapproved LED headlight systems.



Figure 27 – LED Headlight Glare

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<sup>36</sup> <http://www.softlights.org/wp-content/uploads/2022/02/NHTSA-ADB-Final-Rule-Response.pdf>

<sup>37</sup> <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813240>

## Product Liability

A product liability lawsuit is a legal action that the plaintiff (a consumer) brings against the manufacturers, distributors, and/or retailers of a product that injured them by virtue of a defect of design, manufacture, or marketing.<sup>38</sup> The Ban Blinding Headlights petition<sup>39</sup> has tens of thousands of signatures from people who are potential plaintiffs in a product liability lawsuit against GM. GM's use of unapproved LED headlights that are known to cause eye damage, loss of vision, distraction, and emotional trauma, makes GM liable. GM's violation of the Motor Vehicle Safety Act and Americans with Disabilities Act are additional liabilities.

## Style versus Safety

GM has chosen to design and sell vehicle headlights and Daytime Running Lights based on style, rather than functionality. GM has chosen to design and market headlight systems that appeal to buyer's desires of power and pizzazz, rather than safety. LED headlight housings are not seen by the driver, so what they look like is irrelevant in terms of safety. What is seen is the high intensity, non-uniform, and excessive blue wavelength light emitted by the LED headlights and this is not safe.

GM's use of 6500K LED headlights with excessive amounts of blue wavelength light is causing short term and long-term permanent eye damage. We have seen nothing on GM's website that shows that 6500K LED headlights are safe for the eyes. This makes GM negligent for failing to ensure that their products are safe.

NHTSA has studied Daytime Running Lights and found no reason for their use.<sup>40</sup> The analysis found that DRLs have no statistically significant overall effects on the three target crashes. This study was performed in 2008, prior to the use of flat surface LEDs by GM. In other words, GM has chosen to add a feature which uses unapproved LED technology, distracts drivers, and causes negative neurological responses for the purpose of adding "style" and for complying with the laws of Canada. GM would be smarter to comply with the laws of both the USA and Canada when designing and selling their vehicles. LED Daytime Running Lights are a dangerous product.

We know of no studies that show that LED headlights are better at protecting driver and pedestrian eyes than tungsten. Does GM have any studies showing that GM's switch to LED headlights has improved overall public health and safety? Everything we have read shows the opposite.

## Civil Rights and Discrimination

LED headlights violate the fundamental civil right of humans to be able to see, think, and concentrate, and their freedom to be able to use their eyes to look in any direction.

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<sup>38</sup> <https://www.gacovinolake.com/product-liability/what-is-a-product-liability-lawsuit>

<sup>39</sup> <https://www.change.org/p/u-s-dot-ban-blinding-headlights-and-save-lives>

<sup>40</sup> <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811029>

LEDs are known to trigger life-threatening epileptic seizures, migraines, and panic attacks because the non-uniform energy, the unnatural spectral power distribution, and the flicker combine to overload the human nervous system. Some of these stories have been shared publicly.<sup>41</sup>

GM is liable for these violations of civil rights and for the discrimination that GM's LED headlights cause.

## Petition

NHTSA states that they received over 5,000 comments about glare from halogen headlights. NHTSA has not stated how many comments they have received about glare from LED headlights, but over 30,000 people have signed a petition and provided comments.<sup>42</sup> Below are a few of the comments on the petition, showing that by using flat surface LED headlights in their vehicles, GM has created dangerous conditions.



**Makaila Carpenter**

2 days ago

I have an astigmatism and these LED headlights make driving dangerous and nearly impossible.



**linda kelly**

3 days ago

Lights blind other drivers and cause deaths and accidents



**Tina Dougherty**

3 days ago

I totally agree with this petition. I don't like driving at night for this reason! It is so dangerous for these lights to be used as headlights.



**Ruth MacGabhann**

3 days ago

These lights are blinding and make driving in the dark very difficult!



**Vanessa Herrera**

4 days ago

I have to pull over every time someone with led headlights comes towards me. If I look at their lights. I'm blinded for several minutes

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<sup>41</sup> <https://www.softlights.org/stories/>

<sup>42</sup> <https://www.change.org/p/u-s-dot-ban-blinding-headlights-and-save-lives>



**wilmot Price**

6 days ago

I have been blinded by these kinds of lights many times.



**Louise Dell**

1 week ago

I have been blinded far too many times by these lights and have had many near misses! In the dark they dazzle you, and then you can't see properly for minutes after



**Christen Croft**

3 weeks ago

I wholeheartedly agree. It's dangerous! When they are coming toward me in a narrow dark road at night, some headlights are so blinding and I have to hope for the best until the other vehicle passes. When they are directly behind me, I have to fold my rearview mirror up (which is dangerous in and of itself, but still less so than not doing it) so that I can see on front of me and that only helps so much, since the glare from them are still blinding me from my sideview mirror. I don't understand why this has been allowed to become such an issue, in the first place. I hope this will save some lives.



**ryan hansmann**

3 weeks ago

I am a professional driver and the harsh white light makes working dangerous and hard to see while driving at night.



**Kenneth Moya**

4 weeks ago

We're in Southern California where there's streetlights every 15 feet. You don't need these here, and we NEED to be able to see in front of us instead of using both hands to block the rear and side view mirrors when you're behind us.



**Jenny Isadore**

4 weeks ago

LED head lights are blinding and very dangerous. Especially at night in the rain when you can't see the lines on the road or anything in front of you because you're blinded by LED head lights.

## Summary

Based on the evidence provided above, GM must take the following actions:

- 1) Train all staff and leadership on the differences between point sources and flat surface sources of light and how these differences impact eyes and nerves.
- 2) Train all GM staff and leadership to understand that shining non-uniform light at a person violates their civil rights.
- 3) Collaborate with the US Access Board to develop guidelines that ensure that vehicle lighting does not discriminate.
- 4) Update all design software, test procedures, and legal documents to differentiate between point sources and flat surface sources of light.
- 5) Circulate the Ban Blinding Headlights petition to all GM employees, contractors, and vendors for signatures and comments to demand that NHTSA regulate LED lighting.
- 6) Eliminate distracting and discriminatory LED lighting systems from the front, rear, and sides of GM vehicles.
- 7) Recall all GM vehicles with LED headlights, Daytime Running Lights, brake lights and taillights, as they are dangerous products that do not comply with NHTSA FMVSS-108.

Sincerely,



Mark Baker

President

Soft Lights Foundation

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