MOTOR VEHICLE LIGHTING COUNCIL

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Participating Companies
Automotive Lighting Corporation
Guide Corporation
Hella Lighting Corporation
II Stanley Co., Inc.
North American Lighting, Inc.
Valeo Sylvania
Visteon Corporation

May 19, 2003

The Honorable Dr. Jeffrey Runge
Administrator
National Highway Traffic Safety Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

Re: Motor Vehicle Lighting Council Comments on NHTSA Request for Comments; Glare from Headlamps and other Front Mounted Lamps – 49 CFR Par 571, Docket No. 01-8885 Notice 01, RIN 2127-AH81

Dear Dr. Runge:

The Motor Vehicle Lighting Council (manufacturers of automotive lighting products for the motoring industry, Valeo, Hella, Automotive Lighting, North American Lighting, Guide Corporation, Stanley, and Visteon) hereby submits comments on the above-identified Notice; Request for Comments. We are aware of the complaints of headlamp glare received by NHTSA and believe that various actions could be taken to relieve the current roadway situation, including research that may be necessary to fully understand the impacts of possible actions to reduce glare.

The Motor Vehicle Lighting Council supports NHTSA's efforts to address the concerns of the public. We are willing to co-operate in tangible ways to find equitable solutions that will meet the needs of the motorists, government, and industry.

In this document, we have commented on only those questions that relate to vehicle lamp manufacturers. We did not respond to questions that are more properly addressed by vehicle manufacturers or light source manufacturers.

The preamble notes that the notice "…discusses these and other issues, some potential solutions and asks some questions that we hope will help us find some practical and effective solutions for the American Public". We support NHTSA efforts to solve these very complex problems and offer points-of-view and suggestions that could potentially lead to solutions to these problems. The factors that contribute to "glare" are numerous and some are persistent and some are transient. The overall solution will require evaluation of these complex interactions and making decisions and compromises that will yield the best result for the motoring public. We are pleased that NHTSA has taken a global viewpoint by including many questions related to international lighting standards and regulations. We believe that all sources of information are pertinent to a viable overall solution. Hopefully, the actions initiated by NHTSA will be introduced to the Economic Commission of Europe (ECE) through your representation on the Groupe of Rappateurs Eclarage (GRE) so that harmonization of lighting regulations may be considered.

We also support the continued involvement with SAE, the SAE Lighting Committee and the UMTRI Industry Affiliation on Lighting and Visibility to address these issues. SAE has been very active in addressing many of the questions, although not all, relating to the issues of glare from forward lighting devices. There have been standards and information reports published in the recent past that investigate several of the issues related to glaring lamps. It is our recommendation that these documents be considered in the development of any new lighting regulations.

The situation is similar with UMTRI. They have been very active in the lighting industry with relevant research related to many of the topics included in the request for comments.

We also recommend that other forums be challenged to support this mission. The issues related to glare are not just issues for the United States, but are pertinent to all industrialized nations. The investigations and recommendations that are developed from the efforts of the NHTSA should be valuable to particularly the ECE. We recommend that NHTSA actively involve the ECE, GTB and GRE in participating, evaluating, contributing, and harmonizing these efforts.

Summary of Recommendations: The Motor Vehicle Lighting Council believes that there are many contributors to the issue of motor vehicle glare and that there is no one solution that will significantly reduce the perception of glare. We believe that the following areas should be investigated as potential contributors to glare reduction:

1) Consider adoption of SAE J1735 Harmonized Headlamp Performance Requirements or the recent GTB proposal for harmonized low and high beam currently before the GRE. The lower glare levels proposed in these proposals are 35% less than the current standards in FMVSS 108.
2) Consider the development of a combined right and left headlamp photometric standard that will allow maximum utilization of the strengths that each headlamp can offer to the overall beam pattern.
3) Retain current testing practices.
4) Retain the use of HID and other high lumen sources.
5) Control/limit the use of coated light sources or high lumen sources that exceed the standard light source requirements.
6) Consider the recommendations provided in the SAE Report on Headlamp Mounting Heights and until vehicles with limited mounting heights are on the road consider urging manufacturers to aim highly mounted headlamps slightly downward in accord with SAE J599.
7) Do not mandate washing systems at this time for specific types of lamps. Investigate the safety benefits of incorporating leveling systems with HID light sources.
8) Adopt the most recent SAE J583 for fog lamps and consider adopting new reference standards for many other types of lamps including front cornering lamps.
9) Adopt new glare limits for all forward lighting devices as recommended by SAE including the veiling glare test points and procedures.
10) Consider regulating all other forward lighting devices particularly for glare limits and vehicle aiming requirements.
11) Consider the weighting of glare versus sign lighting more in line with driver seeing distance issues that could be affected by glare reduction efforts.

RESPONSE TO NHTSA'S QUESTIONS

Question 1: Given the vast amount of new technology in headlamp hardware and design, and in the design of light sources, is the long-standing method of specifying a single headlamp's performance by test points irrespective of its particular vehicle application, still an effective way to consider the problem of glare? Please explain.

Response: The current method for specifying headlamp performance using test points for each headlamp is still a viable method for evaluating headlamp performance. Even with the range of vehicle mounting that exists, the greatest majority of headlamps can still be effectively tested and evaluated using current practice. Therefore, the current method should be retained as an acceptable testing method.

Question 2: Is there any feasible alternative, such as having many more test points in and near the glare areas in the beam? Would applying intensity zones for glare be appropriate instead of points? Would a whole vehicle roadway illumination specification solve the problem, limiting the glare regardless of lamp mounting height? Please discuss these and fully explain your reasoning for your choice or suggestions.

Response: An increase of the number of test points in and around the glare area will not improve the glare performance of the lamp. It will likely only reduce the seeing performance of headlamps.

Current test lines in the glare area from FMVSS 108 such as 0.5U-1.5L to L rarely if ever require testing beyond the 0.5U-1.5L point. Since a gradient is produced from the high intensity area toward 0.5U-1.5L, any point on the line past this point will be a lower value. Adding more points into the field only adds complication and additional testing time. The current lines of measurement only need to consider the closest point to the high intensity area.

Creating zones instead of specifying test points is certainly possible as demonstrated in ECE headlighting regulations; however, zones should not be used to delineate glare boundaries. The perimeter of zones that are closest to the high intensity part of the beam pattern are the most significant boundaries since light transitions inherent in lamp design will always produce lower light values at greater distances from the high intensity area. Point values are a satisfactory way to indicate where transitions in illumination are necessary.

The concept of specifying actual roadway illumination has merit for other aspects, it will not provide much improvement in glare reduction and may have adverse effects on other aspects of driver vision (e.g. overhead sign illumination). It will make testing very complicated since headlamp height and separation will have to be considered for each test. Current methods of testing individual headlamps should be retained.

The development of a single photometric table that considers vehicle glare as a whole has some potentiality is recommended that NHTSA consider a combined headlamp performance specification. This should allow mathematical summation of intensity values and should not require expensive facilities for photometric measurement of whole vehicles.

Question 3: To what extent do lamp or vehicle manufacturers consider potential glare from headlamps beyond the glare limits set in the Federal lighting standard? What assessment is made of potential glare from lamps at points in the beam pattern that are unregulated? Are there any lamp or vehicle manufacturer corporate design guidelines that lamp or vehicle manufacturers use at unregulated points in the beam pattern? If so, please indicate what those guidelines are and explain why the manufacturer believes they are appropriate. Please provide examples of specific headlamp designs and identify changes that were made to the beam pattern specifically to reduce glare for other drivers, even though the beam pattern met the existing Federal standard.

Response: Few lamp manufacturers use any special additional glare test points. Manufacturers generally rely on subjective laboratory evaluations and night drive evaluations of prototype headlamps on test vehicles to evaluate glare beyond the limits specified in FMVSS 108.

Question 5: To what extent do lamp and vehicle manufacturers consider the reports and work by the Society of Automotive Engineers and other non-governmental bodies on the subject of glare in designing the performance of lamps on their vehicles? If so, please provide a list of the reports, papers and data that you use. Please provide specific examples of internal glare limits that have been adopted as a result of these references.

Response: Original equipment lighting manufacturers actively participate in various organizations including SAE, UMTRI, GTB – SVP, GRE, CLEPA, ISO, IEC and other national and international organizations and review the research and reports by such organizations.

For specific internal glare limits used by manufacturers, see our response to item 3.

Question 6: Should the U.S. adopt the HID glare control measures of automatic leveling and washing that have been adopted by Europe? Please identify the data and analyses that support your views.

Response:

NHTSA should not adopt the European stands for HID washing systems. The benefits are minimal and the costs are in no relation to the achieved benefit. NHTSA should continue to investigate the benefits of automatic leveling systems for high performance headlamps systems, like HID.

Question 7: Should the U.S. adopt the driver operated manual headlamp leveling for halogen and/or HIDs that has been the norm in Europe? Is there evidence that leveling devices are used by many drivers? What would the costs be from adopting these?

Response: The U.S. should not adopt manual leveling due to the uncertainty of the usefulness of this feature and the potential for its misuse by drivers.

Since cost would vary from company to company, we expect that individual members may discuss this in their corporate responses.

Question 8: Because reducing glare might improve older persons' mobility, and improving roadway illumination may do so too, given the age trend, should the reduction of glare be a priority, even at the expense of some visibility?

Response: Visual performance should not be compromised. Reduced visibility is not in the interest of the driving public, including older drivers. As stated in SAE J1606 OCT 97 Headlamp Design Guidelines for Mature Drivers, older drivers need significant increases in visibility due to several factors that affect light transmission in the aging eye. To the extent that any glare tradeoff will decrease the light required for visibility, there should be no lessening of the forward illumination that is necessary for older drivers to perform the driving tasks of lane maintenance and visual detection and identification.

Question 10: Is it reasonable for the United States to sacrifice some visibility at night to address the glare problems identified by the driving public? Would a move closer to the European headlamp beam pattern effectively address glare concerns? Please provide any data that are available on the glare with European headlamps. What would be the effects on visibility at night from switching to a more European beam pattern with its downward aim? Please provide available studies on the comparative visibility of roadway and sign targets with the current European and U.S. headlamp beam patterns, and what the safety and cost consequences of those tradeoffs are.

Response: First, we should consider that glare "problems" or complaints have several potential causes that have nothing to do with beam patterns. Before any sacrifices are made that could affect the safety of the public we should be sure that we have other glare causing factors under control or fully understand their contributions to the issue. These include: a) headlamp mounting heights (SAE J2584 Draft 2002 –Passenger Vehicle Headlamp Mounting Height), b) headlamp height compensating downward aim angles (SAE J599 AUG 97), c) aim of other auxiliary forward illumination lamps, d) the use of aftermarket modified headlamps, especially those modified for HID bulbs without certification to FMVSS 108 physical and photometric performance requirements, e) the use of colored or coated bulbs where such modification affects photometric performance, f) bulbs illegally marked DOT and g) use of bulbs intended for off-roadway use only. Most of these items can be addressed immediately through enforcement and have some tangible effects on the glare problem.

Secondly, it is not reasonable to sacrifice visibility to achieve a potential reduction in perceived glare. See our response to item 8 for the affect of illumination reduction of the older driver; they need substantially more light down the road, not less.

Thirdly, switching to a European beam pattern with downward aim would lessen visibility down the road without eliminating glare complaints.

Question 11: What would be the cost impacts, if any, for lamp manufacturers if the U.S. headlamp beam pattern were changed for new lamps? Please provide a detailed breakdown of how that cost impact was estimated.

Response: For the cost impacts please see responses from individual members who are lamp manufacturers. The cost to reprogram testing software and machines would not be substantial.

Question 12: Is it conceptually feasible to produce a viable beam pattern by retaining test points needed to ensure adequate sign visibility in the U.S. while moving to European values and test points to reduce glare for other drivers? If feasible, might this beam pattern be adopted as a global standard?

Response: It is not feasible to employ the current ECE type beam pattern and yet satisfy the U.S. sign visibility requirements. Additionally, it is not advisable to compromise light needed down the road beyond the levels accepted for visual/optical headlamps. However, it may be possible to adopt the harmonized low beam pattern of SAE J1735 SAE that is very similar to the visual/optical photometric values if an adequate method of sign lighting can be developed. It must be remembered that sign light for U.S. roads must be adequate for residential, city and suburban unlighted sign locations which are primarily on the right side of the roadway, as well as for freeway and highway locations.

Question 13: Because NHTSA's funds for safety initiatives are finite and the agency must use its judgment in deciding which initiatives are the most appropriate, is it appropriate for NHTSA to initiate an effort to develop an updated balance between glare and roadway illumination from headlamps at this time? On the other hand, if NHTSA does not undertake such an effort now and the public's complaints about glare continue to increase, what are the likely consequences?

Response: Many of the new headlamp technologies being introduced by the car manufacturers offer more light on the road. Where the population of the U.S. on average is becoming older, it is a must to provide enough illumination for adequate visual performance. If a decision is made to change the compromise of glare versus seeing light for the sake of glare reduction, the great benefits of additional seeing light will be greatly negated.

There is considerably more potential for accidents to occur due to a lack of seeing distance and obstacle and pedestrian detection than from the negative effects of headlamp glare where the consequence in glare is still only in the subjective discomfort area.

Opting for the ECE beam pattern with the corresponding aiming method is not a good solution. Moving in the direction of reduced light above horizontal is a good solution, and even better if individual headlamps can be tailored to deliver optimal performance. Additionally, several of the items we mentioned in our response to item 10 could contribute to the solution as could the potential adoption of self dimming driver side mirrors along with the interior mirror.

Question 14: If NHTSA begins such an effort, should the desired end be a new beam pattern with the rest of the headlamp portions of the lighting standard retained largely intact, or should the agency aim for a vehicle-based performance standard that evaluates the performance of headlamps as installed on the vehicle? With this latter approach, vehicle manufacturers would have much greater freedom in choosing headlamp location and attributes. The agency's goal could be to simply turn on the vehicle's headlamps and shine them on a screen, and assess the performance of the headlamps, as they will perform when used and seen by the American public. What would the impact on vehicle and headlighting manufacturers from such an approach?

Response: The SAE harmonized beam pattern proposal contained in SAE J1735 has carefully considered the balance of glare and seeing light and has proposed a reduction in glare light below current U.S. standards. This would be an ideal beam pattern to choose. It is also very practical to go beyond this approach and consider combined vehicle lighting standard. Because the majority of vehicles in the U.S. have separately designed optical systems for each headlamp, it would be practical to develop individual beam patterns for each headlamp that would favor their position on the vehicle.

Current test equipment can be used to evaluate each headlamp and then combine data to produce whole vehicle performance. It is recommended that actual complete vehicle simultaneous headlamp performance testing not be considered.

Question 20: Do HID bulbs have too much light flux available for the roadway illumination task? If so, please discuss why and what could be done to resolve this.

Response: HID's do not have excessive light flux for the roadway illumination task. Most of the approximately doubled light flux from HID headlamps is spread out and directed to the sides of the road up to +/- 45 degrees to illuminate areas that are not illuminated with halogen type headlamps. The hot spot of the lamp is increased only moderately over halogen type headlamps; in most cases from 20-25K cd (halogen) to 30-35K cd (HID).

Question 21: How do HID headlamp lower beam patterns vary from halogen lower beam patterns? Do these differences necessarily result in higher levels of glare for other drivers?

Response: As mentioned in the response to question 20, most of the light from HID is directed to the sides. This light is used to create a more comfortable driving situation since the areas to the sides of the road are now more visible. Pedestrians or animals that approach from the sides will also become more visible and not be a surprise to the driver. This wider beam is also advantageous for driving on winding roads since the curves of the road will be better illuminated than with halogen lighting systems.

Additionally, the moderate improvement in forward directed illumination provided by HID should be recognized as an improvement in the overall beam pattern. Higher driving speeds are very common in the US due to the large number of freeways and the additional light in the driver's lane from HID lamps will provide additional seeing distance.

Typical halogen systems have up to recent years only enough available flux to provide light in the more forward field of view. It has only been in recent years that dedicated (four headlamp systems) low beams with high flux halogen sources like the HIR and H7 have been available. These sources can produce much wider beams than with HB3 or HB5 type sources.

The fact that HID has a higher "volume" of light does not mean it will be more glaring. The same limits for glare apply to these lamps as with halogen lamps. The wider beams do mean that they will be visible at much wider angles and this may contribute some perception of lamps being more glaring. The quantity of light may be noticeable and somewhat discomforting to an oncoming driver, but it is not in any way disabling.

Question 26: Are the conventional photometry and color measurement methods specified in current industry consensus standards and national and international regulations appropriate for HID powered headlamps? Does it accurately predict glare or does it underestimate it? What alternative testing methods should be used?

Response: The regulations and standards currently set by regulatory bodies and industry are appropriate for HID headlighting. The response curves for the photometric measurement equipment is calibrated to the typical eye response of humans to all light wavelengths and therefore the measurements for candela closely represent the actual light that will be seen in the field of view on the road. Differences found in an UMTRI study relative to spectral

differences between halogen and HID indicated that the differences between the two are measurable but small. This spectral difference is not enough to explain the subjective difference between halogen and HID found in the same report. (*Subjective and Objective Aspects of Headlamp Glare: Effects of Size and Spectral Power Distribution*, Michael Flannagan, UMTRI-99-36, November 1999)

Question 27: Has there been any research on achieving a more uniform spectral power distribution from HIDs that would be similar to that of a heated metal filament? If so, please provide references and discuss. What would be the safety and economic consequences of a rulemaking change that mandates a more uniform spectral power distribution?

Response: Bulb manufacturers can best respond to the first part of this group of questions.

The consequences of mandating HID out of the market would be the elimination of a technology that provides significantly more light on the road for increased driving safety. It would prevent a source with demonstrated life-of-vehicle performance from being available for the consumer. There are many drivers, especially older drivers, who believe that the illumination provided by HID headlights makes the difference between being able to drive at night and not being able to drive at night.

Question 28: The UMTRI-99-36 study found that to be considered similar in glare perception by test subjects, the halogen lamp had to be about 1.5 times or 50 percent brighter than the comparable HID lamp. What would be the safety and economic consequences if HID headlamps were required to meet photometric intensity performance but limited to about two-thirds of that now permitted? Please explain how your answer is determined.

Response: Decreasing the glare requirements for HID headlamps would certainly put them at a disadvantage with halogen headlamps, that is, it would require a more difficult optical design to comply with the more stringent requirements. Any changes in the beam pattern specifically limiting glare on HID headlamps would put them at a disadvantage when compared to halogen headlamps. A one-third reduction in the glare specification for HID headlamps would result in a significant reduction in the visibility advantages afforded by HID.

The fact that HID has a higher "total amount" of light does not mean it will be more glaring. The wider beams do mean that they will be visible at much wider angles and this may contribute to the perception of lamps being more glaring. The quantity of light may be noticeable and somewhat discomforting to an oncoming driver, but it is not in any way disabling or a detriment to safety.

Question 30: Given that HID light sources are being used in non-headlamp applications such as fog, auxiliary low beam and driving, and for OEM upper beam, should NHTSA regulate any or all exterior lighting devices that use HID light sources on motor vehicles? If so, should the regulated aspects be the same as those required for the currently required lighting devices, or should these requirements be different, more constraining or less constraining. Which lighting devices should have the highest priority to regulate first?

Response: The SAE Lighting Committees recently revised auxiliary lighting standards to reduce the glare levels. This was done because when the upward illumination from other forward lighting devices were added to that of the headlamp, the glare levels could become excessive. Combining multiple lamp designs all using HID sources could result in a negative driver's response due to the extreme amounts of light coming at them. Combined with misaim potential for fog and other auxiliary lamps, it is practical to consider additional regulatory actions to insure that oncoming drivers are not adversely affected. These requirements should extend to aftermarket products as well.

Since fog and other auxiliary lamps are not required by Federal regulations to be aimed, this would be the first prudent action. Reduced glare levels for all fog and auxiliary lamps are also recommended to the newly revised levels in SAE Standards. Other requirements could include abrasion resistance and impact resistance. These lamps are usually in a more vulnerable location than headlamps and susceptible to stone impacts that result in highly abraded surfaces or broken lenses. SAE has prescribed in the newest version of J583 the inclusion of some of these requirements and by adoption of this standard much of the work would be done.

Question 40: Should NHTSA regulate any of these auxiliary lamps? If so, which ones, and why?

Response: NHTSA should consider regulating auxiliary lamps to resolve the situation that now exists where different states require fog lamps meeting different specifications, for example CA and TX have different fog lamp specification. Since states generally do not upgrade their regulations simultaneously or at frequent intervals they will often have different vintage specifications for various auxiliary lamps that are under their jurisdiction. Considering that vehicles do switch registrations from one state to another and travel state to state, it seems reasonable to give the public the ability to expect similar lamp performance with vehicles in different states. Manufacturers will also benefit, as will the public, via a reduction in costs associated with regulatory analysis and paperwork related to the design and approval of lamps as exemptions to state laws (that can be approved by means of submissions to state officials) to state laws. Fog lamps are recommended as the first priority for any action being considered by NHTSA.

Question 41: For fog lamps, should NHTSA adopt either or both of the archaic and the ECE performance for this lamp? In the absence of any modern fog lamp standards, should NHTSA propose a new standard based on the recent, but unproductive, efforts of SAE and ECE? Should NHTSA propose switching, wiring, and aiming hardware performance that, to the extent possible, reduce the incidence of fog lamp abuse? Please provide support for your answer and recommendations.

Response: It is recommended that NHTSA adopt the recently published revision to SAE standard J583 (April 2001). One provision of the revised version of J583 is the incorporation of provisions for reducing misuse of the fog lamps. It is very apparent that most drivers with fog lamps use the lamps under all nighttime situations and not just for fog situations. Many vehicle manufacturers are now voluntarily providing fog lamp switching such that the fog lamp is turned off every time the headlamp switch is turned off and then must be turned on separately if the headlamps are turned on again. This should be made a mandatory requirement. The new SAE J583 includes requirements for wiring that would provide for this capability.

In summary, the misuse of fog lamps should be limited by vehicle wiring and switching modifications.

Question 42: Should NHTSA regulate any of the other auxiliary lamps to minimize, to the extent possible, aberrant performance and misuse? If so, should NHTSA adopt either or both of the SAE and the ECE performance requirements for these lamps, even though some are decades old? In the absence of any modern auxiliary lamp standards, should NHTSA propose new standards? Should NHTSA propose switching, wiring, and aiming hardware performance that to the extent possible, reduces the incidence of their abuse? Please provide support for your answers and recommendations.

Response: The SAE has recently revised several auxiliary lamp standards including those for fog lamps and front cornering lamps. These standards could provide a basis for regulations. NHTSA could encourage the SAE to develop other new or revised standards to meet any need for NHTSA to regulate specific other devices. To the extent that lamps, such as rear fog lamps, are misused and can cause confusion with stop lamps or otherwise impair other safety functions of lamps, their misuse should be limited by vehicle wiring or switching modifications. Wiring or switching should be specified in only those cases where a significant safety issue might exist, such as that caused by glare from front fog lamps, signal confusion caused by rear fog lamps or the need for a vehicle with daytime running lights to have appropriate automatic activation.

Question 43: Should NHTSA require that a standardized voltage be applied to headlamps?

Response: There are potential benefits if voltages to lamps were controlled closer to the design nominal voltage of 12.8V used in lamp design and testing. Many vehicles operated their headlamps at voltages significantly above the current design voltage. The result is increased light output, including increased levels of glare. Longer life can be achieved by maintaining constant voltages near design voltage and by limiting of voltage spikes that occur when the alternator provides high charging voltages in winter (particularly if battery voltage is initially low).

Question 44: What is the actual cost of providing such solutions for bringing on-vehicle headlamp intensity back in line with what is specified for them in the laboratory? Provide an analysis of the source of these costs to justify your answer.

Response: Since cost would vary from company to company, we expect that individual members may discuss this in their corporate responses.