

Comment from Brian Ernesto

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I believe there are pros and cons to camera based rear vision systems, and that the question is not whether they should be allowed to replace mirrors, but that they must meet minimum standards in order to be allowed.

Many automakers implement current required technologies such as backup cameras, vehicle lane keep assistance, and crash mitigation systems. But, the 'quality' and 'capability' of these systems varies wildly from manufacturer to manufacturer and as such, some automakers may cut corners in these systems which could create safety hazards.

A mirror is a mirror, they all reflect the same image, and with the same clarity regardless of automaker. A camera based replacement system would need to meet minimum standards in order to replace them safely.

The standards should be related to mirror replacement video solution should include:

- minimum resolution,
- minimum light sensitivity,
- minimum light responsiveness,
- minimum field of view,
- adequate fowl weather performance,
- minimum driver display quality (off axis, black levels, latency, etc.),
- minimum screen size,
- and proper screen placement

Standards need to be created for 'all' the above criteria before systems should be allowed.

Given that these standards are created, and automakers are able to provide systems that comply, they these solutions could allow for a lot of improvements over existing mirror-based alternatives. Benefits could be:

- Visibility of regions difficult or impossible to obtain with mirrors,
- Highlighting of other vehicles, pedestrians, or other collision hazards,
- Combined images that enhance spatial awareness of the vehicle,
- Enhanced visibility in low light conditions,
- Computer enhanced imagery,
- Improved aerodynamics and efficiency,
- and even improved aesthetics and new vehicle designs.

Note, there are a few significant issues to camera based vision systems:

- The biggest and most difficult to address is subject to viewer orientation using a mirror. Where by, a driver can move their position relative to the mirror to change perspective relative to what

can be seen in the mirror. This can to a certain effect be mitigated with wide angle lenses, but that distortion introduces spatial awareness issues, such as the classic "things may be closer than they appear" warning on convex mirrors.

- The next is regarding human night vision and camera low light sensitivity. It is difficult for modern cameras displays to accurately represent low light images without noise, and display them in a way that does not impair the driver's night vision.

My opinion is that camera based systems should be allowed, but only if the automaker's technology can meet the above standards, and address the above issues adequately. I also believe currently available technology may make that cost prohibitive, if not impossible at this time. But, also that this body should be forward thinking and implement standards that drive this inevitable technological crossover as there are many potential benefits.