

Comment from Christian Holladay

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I believe that the adoption of cameras as a replacement for mirrors is a great idea, and I very much support the ability for car manufacturers to replace conventional mirrors. I also would like to point out a few potential problem points with their implementation and steps that the traffic safety administration could take to mitigate these potential issues.

Positives:

- 1.) Miniature digital cameras are time-tested and relatively inexpensive. It's pretty easy to go on Amazon or any retail store and find a 720p camera for around \$5-\$15 which will produce a decent quality image from a device that can reliably run around the clock 24/7 under constant use. These devices have been used and abused for decades and many are still running in cars to this day. People often use them for modifying older or custom vehicles to provide backup camera technologies to cars for cheap, and we've seen that they work great for this purpose.
- 2.) Mirrors are large, bulky, not very aerodynamic, and provide very limited visibility. One of the biggest issues that cameras will be able to fix is the ability to position them anywhere around the vehicle with a very small profile that doesn't interfere with the aerodynamics and gas mileage of the vehicle in a major way, unlike conventional mirrors.
- 3.) Cameras will give drivers more complete information about the traffic around them. One of the major upsides to camera technologies replacing mirrors will be the ability to stitch together a more complete image of traffic around the vehicle. These images can be passed through all sorts of complex digital interfaces to show lanes, estimate car distances, and reduce the overall profile and gas usage of automobiles while giving the driver more complete information about the traffic around them. A large amount of data from around the vehicle can be gathered and formatted in an easy-to-digest user interface to help with navigation.

Potential issues:

While I think cameras would be great for replacing conventional mirrors, there are a few pain points that I would like to address, for the purpose of better advising on the implementation of these technologies. It may be advisable to set up a sort of 'rating system' where a manufacturer may be rated from 1 to 5 in the following categories based on safety measures taken to ensure the technology is implemented responsibly:

- 1.) Redundancy. Technology, regardless of how advanced, is not immune to failure. It's important to acknowledge the risk of the software freezing, a camera failing, or an unforeseen glitch disabling this essential tool.
 - a.) Redundant mirrors. For the category of redundancy, including mirrors should be rated a 5, for if the system were to fail, a driver would be able to simply rely on conventional mirrors to navigate.

b.) Separate computer systems. It's generally a good idea to decentralize complex computer systems. If you've ever experienced a Bluetooth pair failure or a dashboard freeze, you might understand why it's a good idea to split these systems into separate control modules, in order to prevent one system failure from taking everything else down with it. Depending on the implementation, each 'mirror' could have its own camera and computer pair, such that if any failure occurs on the main system or in one mirror, you still have partial usability. This would be rated at 4 or 3, depending on the centralization of the systems.

2.) Clarity. Naturally, a replacement should provide improved visibility, not worse. It's important to make sure the cameras being used are of good quality and that a vehicle can be identified or spotted from a reasonable distance away.

a.) Information completeness. This technology may enable panoramic views of cars from all directions, and a decrease in blind spots should be given a higher score.

b.) Magnification. Depending on the camera quality, it may be possible to magnify an image to a degree to improve the clarity of a lane for identification or distance purposes.

c.) Quality. As I mentioned earlier about visibility, it's important that high-quality cameras are used. It may be a good idea to have independent testers with a range of backgrounds - from car experts and mechanics to new drivers, from poor vision to perfect vision - to test these camera systems and score them based on the distances they can identify vehicles, and make out important information like the make, model, or license plates of the vehicle.

3.) Durability. It's important that these cameras are able to function in all sorts of conditions, and should be thoroughly tested for weatherproofing, extreme temperatures, and prolonged exposure to elements like sand, mud, and flood conditions.

I hope that some of these points are considered in the adoption of these technologies, to help ensure customer safety and reliability. Thank you for your time.