



[Driving + Mobility](#) Oct 16, 2017

Developing Eyeglass Lenses for Driving

A look behind the scenes: how ZEISS developed DriveSafe.

ZEISS has developed a new eyeglass lens which is optimized for driving. And it's not a special-purpose lens, but an everyday lens which is suitable for all-day use. It offers three key features which make driving safer and more comfortable for eyeglass wearers. BETTER VISION talked to Dr. Christian Lappe, Scientific Affairs & Technical Marketing, and Frank Mielich, Project Manager DriveSafe/Technology & Innovation/New Product Implementation, who were both involved in developing DriveSafe.

BETTER VISION: > [DriveSafe lenses](#) are the latest innovation from ZEISS. How do you go about developing special lenses for driving? And why do it in the first place?



Dr. Christian Lappe, Scientific Affairs & Technical Marketing and Frank Mielich, Project Manager DriveSafe/Technology &

Christian Lappe: The development of DriveSafe was prompted by a customer need which we had identified some time previously. Surveys and customer feedback from our eye care professionals and eyeglass wearers revealed that many wearers feel uncomfortable and even unsafe due to problems with their vision when driving. People were clearly saying they wanted eyeglasses suitable for all-day use which would make driving more comfortable.

Frank Mielich: Good vision when driving is a very complex issue which depends on many different factors, such as defective vision and sensitivity to light. We wanted to find out whether driving involves specific vision problems which affect most drivers to the same degree. We carried out extensive market research in Germany and the USA to determine what could ensure better vision when driving and the types of visual difficulties people face when they're on the road. We were surprised by the large number of vision problems people told us about and also by the fact that these were so sharply focused on specific areas. On the one hand you have the unpleasant glare which is particularly acute in poor light conditions – for example at dawn or dusk, in rain or snow, and at night – and this is compounded by the fact that we actually see less in these conditions. It's something most of us have experienced at one time or another.

Christian Lappe: On top of that, some progressive lens wearers don't feel that their eyeglasses really cater to the rapid head and eye movements that form part of the dynamic vision we need at the wheel. They felt that the limited vision zones provided by traditional progressive lenses could be improved. So basically those were the issues and problems we were facing when we decided to develop a better vision solution for driving.

BETTER VISION: What do these lenses have that conventional lenses don't? Why do DriveSafe lenses make driving more comfortable and therefore safer?

Christian Lappe: There were three key pillars in the development of DriveSafe lenses:

1. understanding how our pupils react when we drive at less favorable light conditions and how the quality of what we see is affected by poor light conditions,
2. the irritating glare we experience when driving,
3. the specific nature of driving while wearing progressive lenses.

The first aspect of the development project was to better understand the role played by our pupils. We know that pupil size changes depending on ambient light conditions. So poor, low-light conditions cause our pupils to get bigger. But the eye's ability to dilate the pupil to let in more light also affects the quality of the image we see. It's a bit like photography where you adjust the aperture of the camera lens to control how much light reaches the camera sensor. However, this setting also affects the depth of field. The more you open the lens aperture, the shallower the depth of field becomes. Our pupils act in a similar way. When the pupil expands, more light reaches the retina and the depth of field is also reduced. In addition, light in the peripheral areas is refracted differently by the lens of the eye. The incident rays are not focused on the right place on the retina, and that can limit your vision if your pupils are significantly dilated.

So when we developed DriveSafe we optimized the lens design to cater for visual performance in poor, low-light conditions where the pupil becomes enlarged. This optimized design is crucial, especially when you're wearing progressive lenses, and it supports DriveSafe's goal of making vision more comfortable even in poor light conditions. The result of our work was the Luminance Design®

technology.

Frank Mielich: The second pillar of the development process was to specifically examine the glare issue. Glare can generally be divided into two types. On the one hand you have 'disability glare', a physiological glare which completely impairs your vision, for example due to a bright flash. And then you have 'discomfort glare', a psychological form of glare which people find unpleasant, irritating or disturbing. Headlights of oncoming cars or street lighting are often cited by drivers as the cause of such discomfort glare.

When it comes to disability glare we have a simple and effective means of protecting our eyes: we either close them or avert our gaze from the source of the glare. That's a sensible response, and it isn't affected by the eyeglass lenses people use on an everyday basis. What we were interested in was the discomfort glare which people find so unpleasant and irritating. One of the best examples is the glare caused by the headlights of an oncoming vehicle in poor light conditions. Scientific evidence, also confirmed by market research, links the perceived glare to headlights of oncoming cars with LED or Xenon H.I.D. (High Intensity Discharge) light sources. The spectral composition of the light seems to play a particularly important role. These modern light sources LED or Xenon HID also show distinct light emission in the high-energy spectral part of our light spectrum, i.e. the spectral band around 440-470 nm.

Christian Lappe: The DriveSafe coating allows us to selectively attenuate this irritating shortwave light, which is the part of the spectrum that produces the glare. Important: Lenses with this coating can also be worn in daylight and are perfectly suitable for everyday use.

Obviously these lenses also meet all the relevant standards for automotive use.

Frank Mielich: And the DuraVision® DriveSafe coating offers the same levels of durability and cleaning properties as our premium DuraVision® Platinum coating!

Christian Lappe: The third and final aspect of the development project was to optimize progressive lenses for driving. When we're driving our vision tend to be in a higher alerted mode. It is more challenging and concentrated, because it's a very dynamic activity for our eyes. We switch our gaze, and hence our attention, from the road ahead to the dashboard, flick our eyes between the right and left side mirrors and the rear-view mirror, glance back at the road...all in rapid succession. The vision zones of progressive lenses must ensure that the wearer experiences clear, natural and relaxed vision at all distances. That's why we focused on optimizing the lens design to meet the specific vision needs of drivers. But at the same time we didn't want drivers to have to change their eyeglasses the moment they got out of the car. The distance vision and transitional zones of the DriveSafe progressive lenses have deliberately been made large enough to provide optimum support for a driver's eye movements. At the same time, the near zone of the lens is large enough for activities such as reading, so the eyeglasses can be worn all day long.



BETTER VISION: How do you test those kinds of lenses?

Frank Mielich: We put DriveSafe through a whole series of scientific analyses to give us the best possible insights into the three key issues we've been talking about. Test wearers tried out and verified each new design characteristic to see how it affected their vision when driving and whether

each new DriveSafe prototype significantly improved their vision. That's how we got to the final version of the DriveSafe product.

We also carried out studies to find out when people feel dazzled. What are people's 'pain thresholds' when it comes to discomfort glare? How strong does glare have to be before you are unable to do something such as read letters? And how is that affected by different products, glare intensities and coatings/filters? We tested the lens prototypes exhaustively to discover how they affected people's vision. And we had multiple test subjects trying out our prototypes and giving us their subjective feedback based on a very extensive questionnaire. One of the most important things within the study was how people felt wearing the new lenses, both when driving and in everyday use. This kind of real-life testing is crucial, so we made sure that extensive internal and external wearer trials were an integral part of this project.

We worked with the FKFS Research Institute of Automotive Engineering and Vehicle Engines Stuttgart to analyze how people move their eyes and head when driving. We wanted to know how they refocus their gaze, where exactly they look, and how long they maintain that focus, as well as how they move their eyes and head. We answered those questions by putting test subjects in a special test vehicle equipped with cameras and watching their head and eye movements while they drove. That gave us important insights into how we could optimize progressive lenses for driving.

BETTER VISION: What do people focus on when they drive? And how do they shift their focus? How is it different from other everyday activities?

Christian Lappe: The modern world demands more and more of our eyes. In many cases we are not even aware of this, but the way we live nowadays is forcing our eyes to work in new ways. The development of Digital Lenses is one example of how we have responded to these changes. We spend far more time using our close-up vision now that smartphones, tablets and similar devices have become so popular. As a result, we're constantly and rapidly shifting our attention and gaze from near to far objects. That gets tiring for our eyes in the long run, and it can eventually lead to symptoms of eye strain.

Driving involves a different kind of vision behavior altogether, and it exerts a different kind of strain on our eyes. It requires a dynamic form of vision which involves constant head and eye movements. As well as keeping our eyes on the road, we have to monitor our surroundings – both directly and through our mirrors – and constantly glance at and operate dashboard instruments. The studies we carried out with FKFS showed that we look at the road 96% of the time. That surprised us because we thought the percentage would be lower, perhaps 80% of the time looking at the road and 20% at the instruments and mirrors. But we also found it reassuring, because keeping an eye on the traffic is, after all, the most important aspect of driving! Nevertheless it also means that we obviously squeeze all our glances at the wing mirrors, rear-view mirror, and dashboard into a very small period of time. That's certainly not 'normal' visual behavior, and it's extremely tiring for our eyes, and the visual system overall. Probably the only other situations where you would glance around so quickly would be when you are doing things such as crossing a major road in Paris or hunting for the best bargains at a sale! And when we're driving our eyes are having to do this for long periods, and sometimes in difficult conditions.

So I guess it's not so surprising that lenses specifically designed for this purpose can provide better and more relaxed vision.

Frank Mielich: And that's what our test wearers and the first DriveSafe lens wearers have told us, too. We were absolutely delighted with the tremendously positive feedback we got on the final product from both single vision and progressive lens wearers. And of course the DriveSafe range also includes a specific lens for wrap around eyeglasses.

BETTER VISION: What was the most exciting moment for you personally during the development of DriveSafe?

Frank Mielich: We started off by testing a few prototype versions with different combinations of lens designs and coatings (2x2 combinations) in a small group of experts. Testing a new product yourself is always an exciting moment in a project, perhaps the most exciting of all. That transition from theory to practice is full of unknowns, but it's exciting.

I took those lenses with me when I finished work that day and tried them out on the drive home. I wasn't impressed with the first version, so I switched to the next product combination and tried it out in front of my car's xenon headlights. It was an amazing feeling! I thought to myself: we could really be onto something here...

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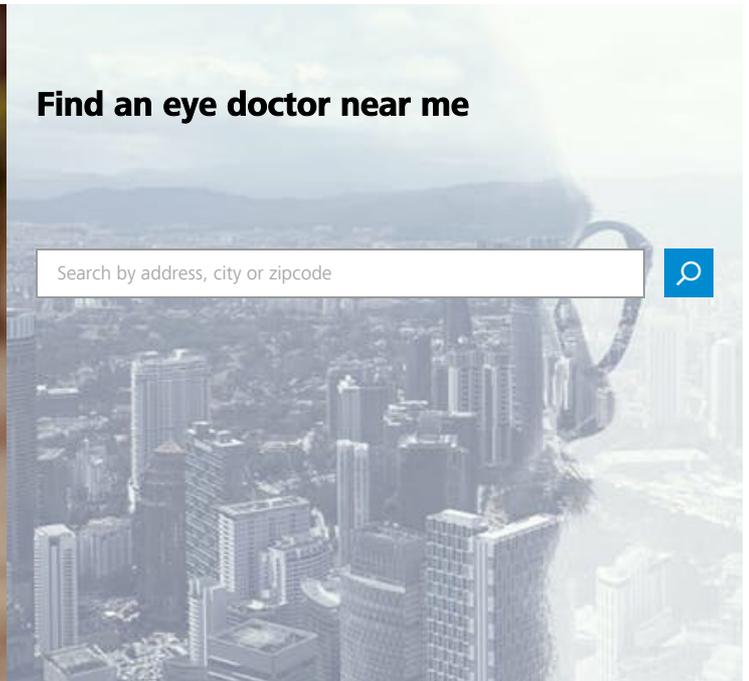
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sunlight, fog or on wet or reflective roads - not to forget the many other road users, signs and information they have to note. However, the right eyeglass lenses can turn even long and frequent drives into pleasant and, most importantly, safe journeys. But what makes the ideal pair of driving glasses?

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