

EYE TRACKER STUDY OF RETROREFLECTIVITY PERCEPTION BY DRIVERS

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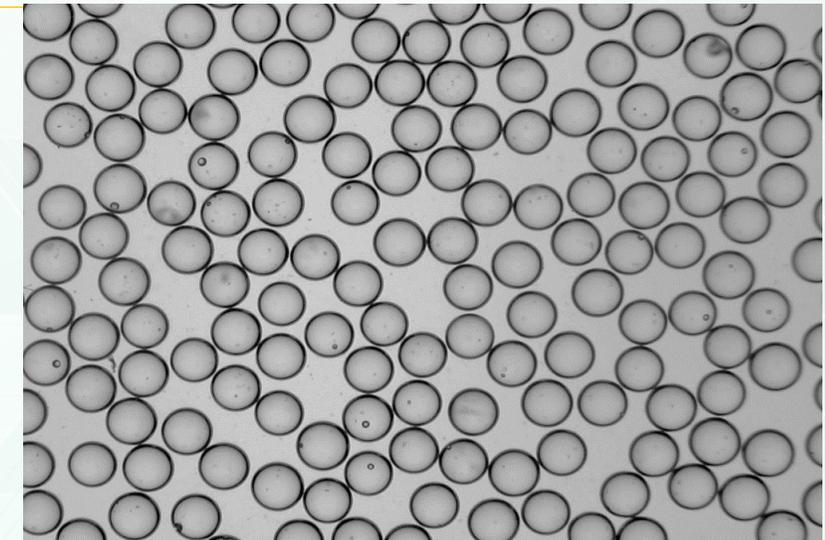
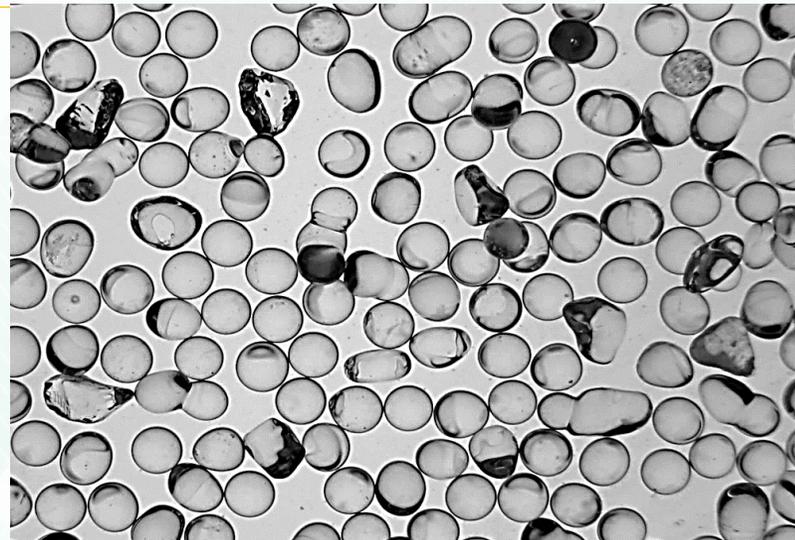
Road markings as visual guidelines



Glass beads

Protection of paint and retroreflectivity

	Standard	Premium SOLIDPLUS
Production technology	Typical, vertical furnace, 1200 °C	Proprietary
Starting material	Recycled float glass	Selected raw materials
Refractive index	1.5	1.6-1.7
Roundness	>80%	>90%
Initial retroreflectivity	~400 mcd/m ² /lx	~1000 mcd/m ² /lx



Test stretch

Test stretch – renewal of structured cold plastic:

- STANDARD – low R_L : Solvent-based paint + standard glass beads
- PREMIUM – high R_L : Waterborne paint + premium glass beads
- Poland, voivodeship road 786, two-lanes, 3.05-3.25 m each, AADT 4072, test stretch 23 km
- Edge and centre (single or double) markings (each 12 cm wide)

System	Standard			Premium			
	Line	Right	Centre	Left	Right	Centre	Left
R_L [mcd/m ² /lx]	202	278	218	319	618	331	
R_L [mcd/m ² /lx] after winter	182	112	170	265	236	263	

Two-year marking durability with premium (high R_L) system

First eye tracker study on retroreflectivity of road markings in the field

Eye tracking

- Data per 12-18 test participants (amongst 25), 20-23 years old, licensed for 3-5 years
 - Analysis of similar road stretches (straight, no street lights)
 - Removed data for superfluous lighting (preceding or passing vehicle, lighted stretches, etc.)
- Gazes at road markings with high R_L (618 mcd/m²/lx) vs. low R_L (278 mcd/m²/lx)
 - **Normalised for 100 m stretches**
 - **Baseline: gazes during day time**
 - Major difference only in R_L of centre line

Stationary eye tracker

- Mounted on steering column
 - Data loss with head movement (15-28%)

Visual field division

- 5 zones analysed



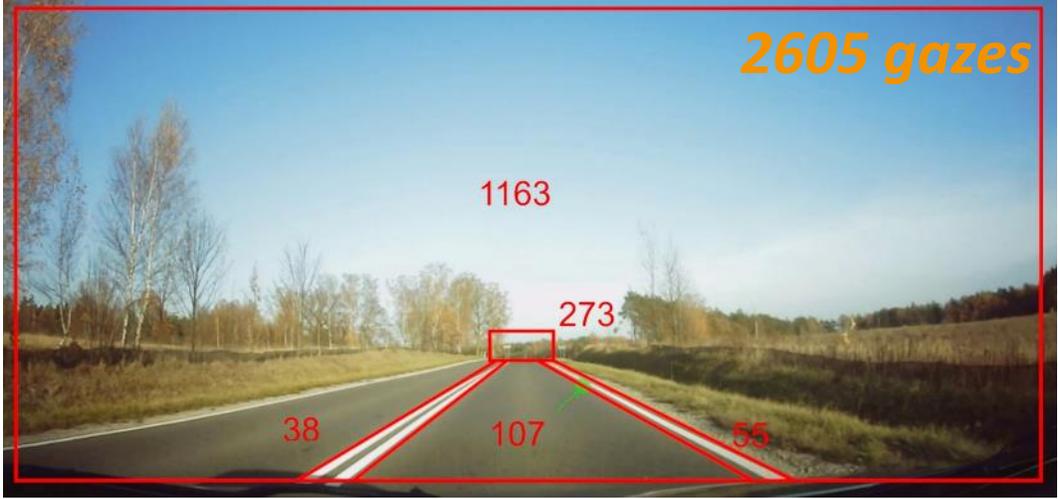


Average gazes per 100 m stretch

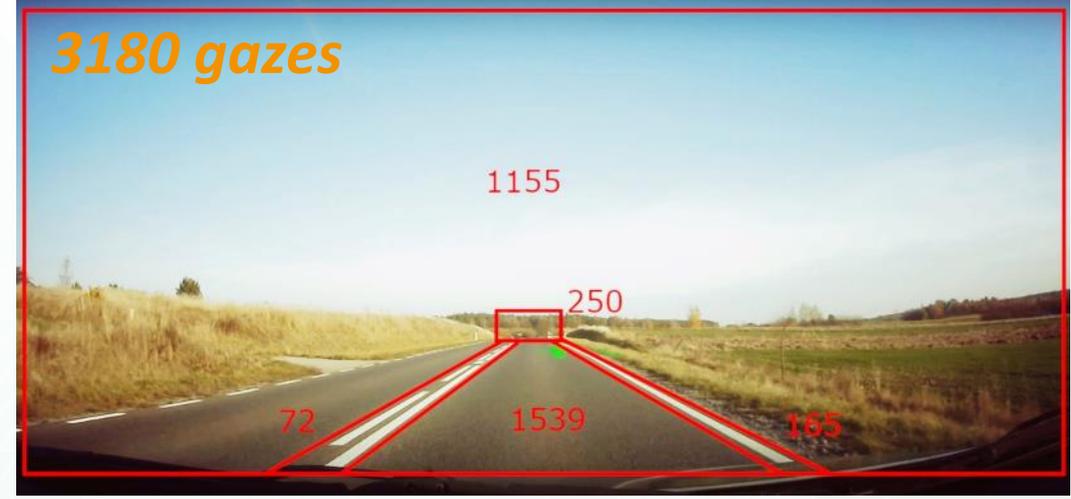


Baseline
(gazes during daytime)

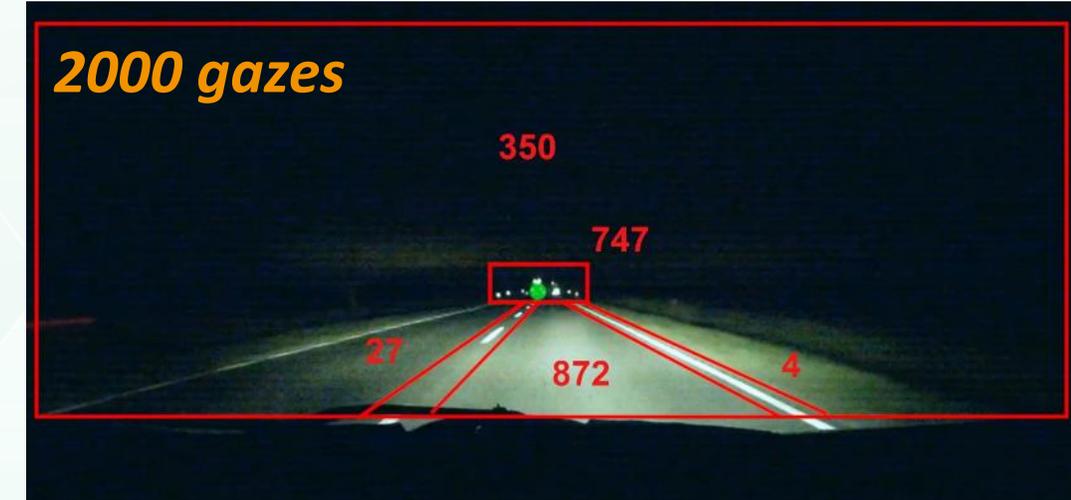
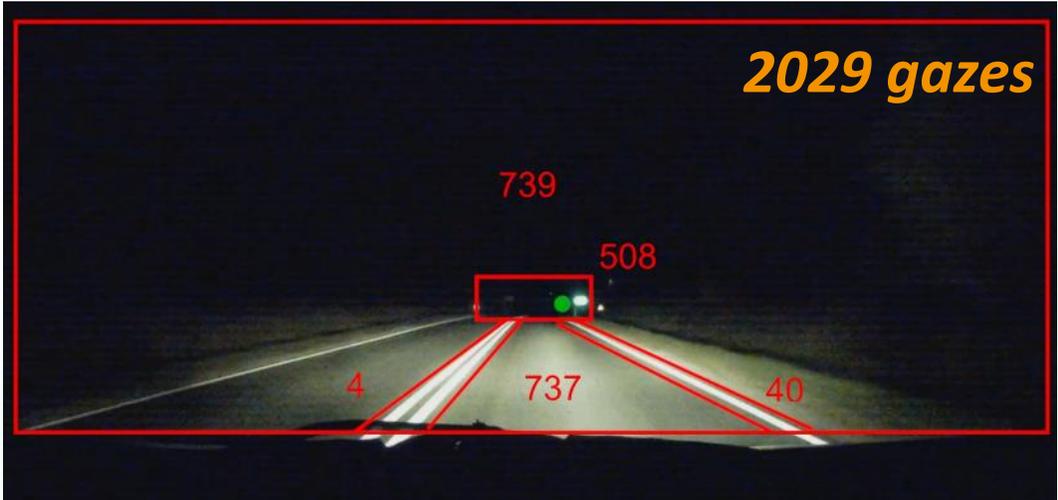
Low R_L



High R_L



Night time



Results eye tracker study

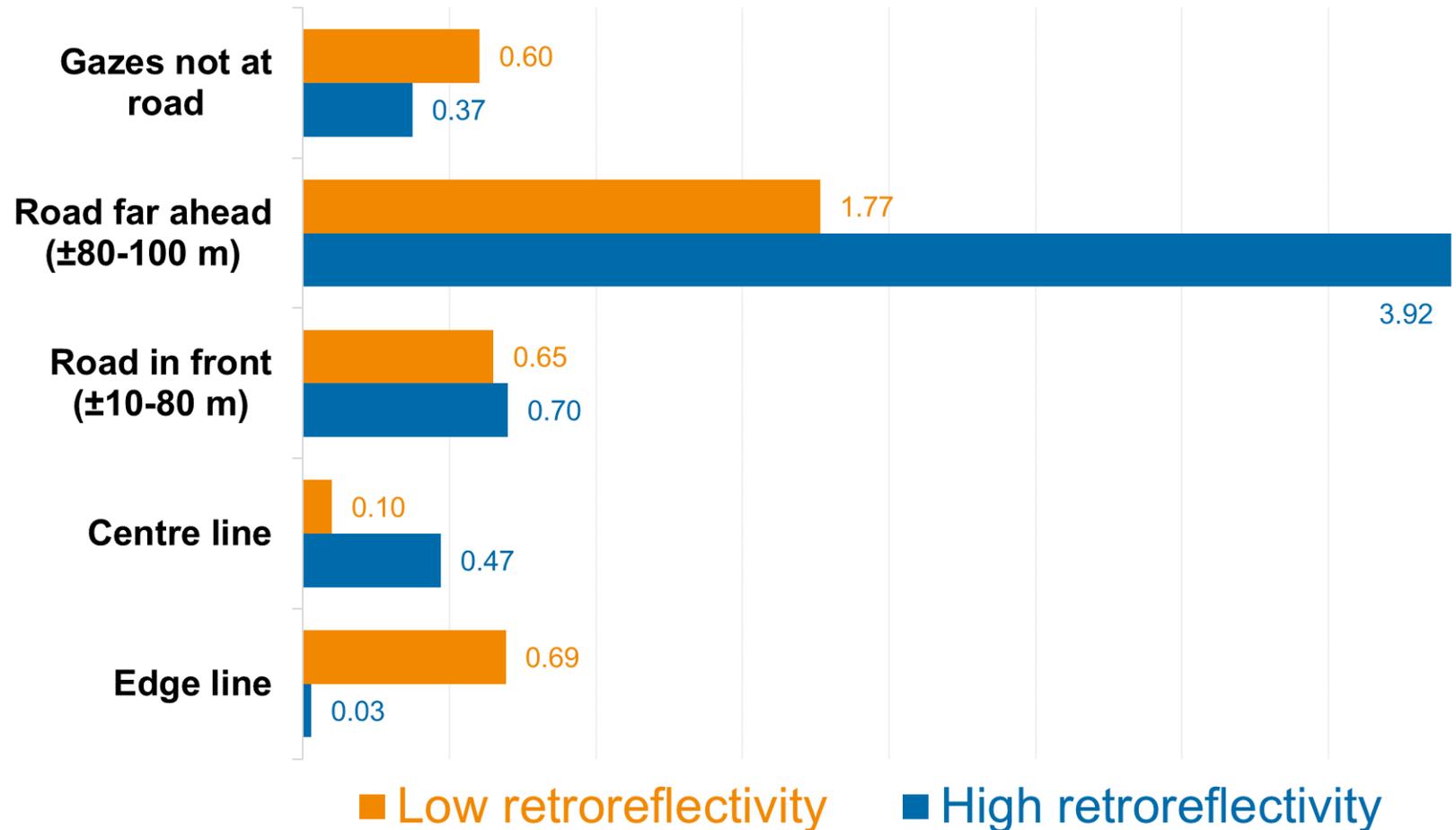
Highly desired – road far ahead
(±100 m) guides steering

Shift of gazes toward high R_L



Gazes at night

(versus baseline: gazes during daytime = 1.00)



Results eye tracker study

	Low R_L	High R_L
Gazes at road marking at night	45% of daytime gazes (centre line – 10% of daytime gazes)	16% of daytime gazes (centre line – 47% of daytime gazes)
Gazes at centre line (difference in R_L)	Very low observance at night (0.2% gazes) and low at day (1.5% gazes) <i>Seven times less gazes at night than during daytime</i>	Similar observance at night and day 1.3-2.3% of all gazes <i>Fifteen times more gazes at night than during the day</i>
<i>Shift of gazes to line with high $R_L = R_L$ guides steering</i>		
Gazes at road ahead		Twice more gazes at far field than in case of low R_L
Gazes not at the road	36% at night, 45% during daytime <i>High R_L brought advantageous shift of focus to the road far ahead</i>	8% at night, 39% during daytime

Conclusions

Eye tracker study of drivers in the field – day and night

- No prior reported similar experiments
- Compared road markings with high R_L (618 mcd/m²/lx) and low R_L (278 mcd/m²/lx) at centre line
- Gazes, normalized to 100 m stretches, as compared to daytime baseline

Results (at night, with high R_L)

- Shift from edge (low R_L) to centre line (high R_L)
 - **Retroreflectivity used for guidance**
- More gazes at far field
- Less gazes not at the road



Effects on road safety

- Unknown. No studies so far
- Additional research needed and planned

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