Informal document GRE-70-16
(70th GRE session (21-23 October 2013,
agenda item 5(f))

Dynamic Turn Indicator: Research/Investigation Findings

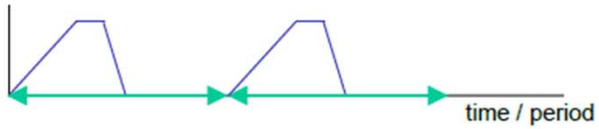
General Topic:

Session Oct. 2012: Discussion about

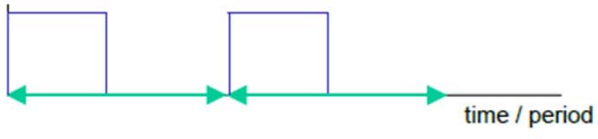
Variable Intensities Direction Indicators

Demonstration of rear lamps only

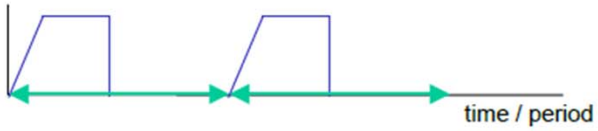
- Bulb direction indicator



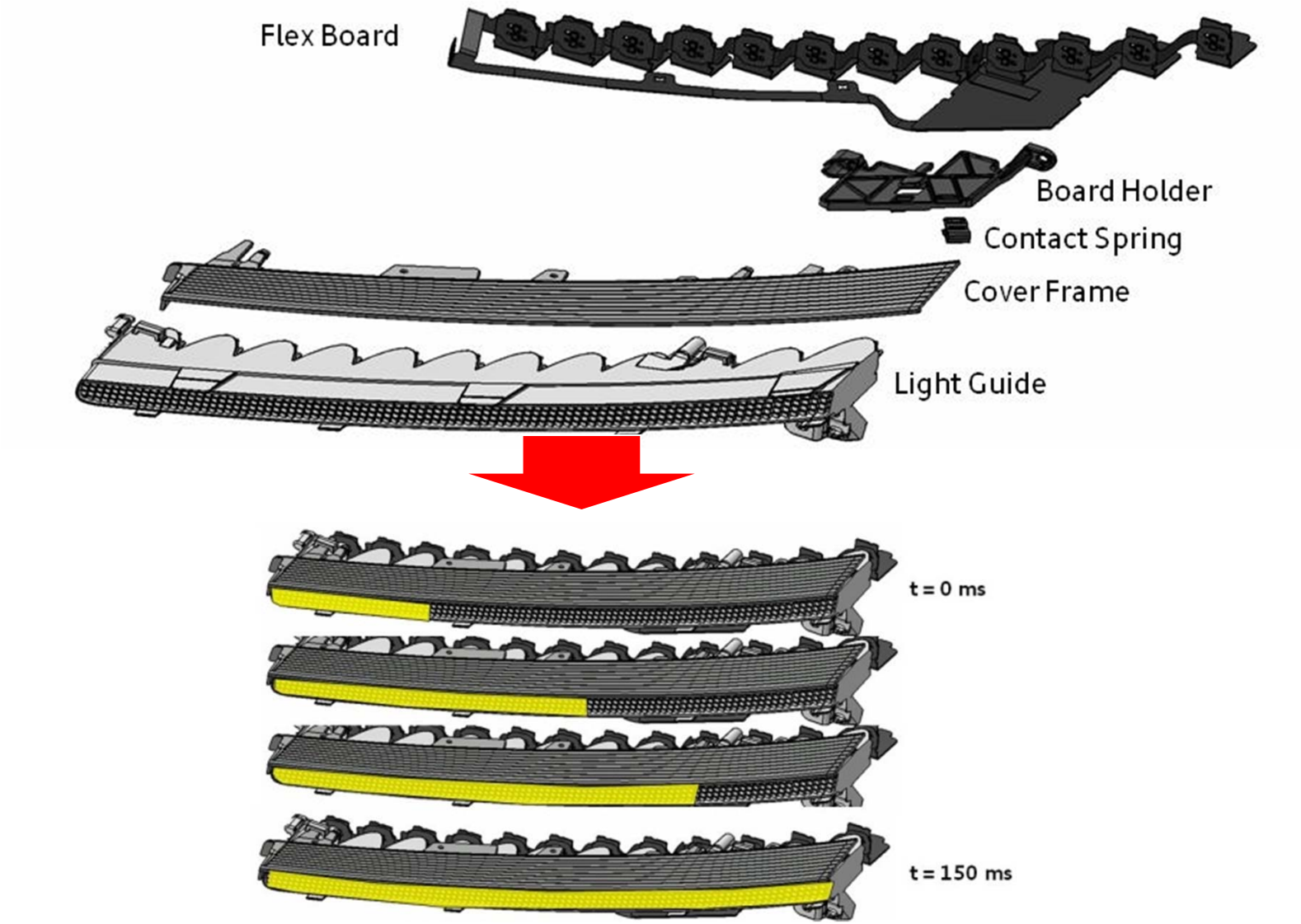
- LED prototype static direction indicator



- LED prototype with variable intensities indicator



Technical Solution for Dynamic Turn Indicator



Research Assumptions, Area of Investigations

During various sessions, lack of research and investigations was stated in GTB/GRE.

Unknown effects (1):

- Distraction from dynamic effects in comparison to other dynamic lights in environment
- Information of the other road users about the turn direction
- Effects of half hidden vehicle, Motorbike etc.

→ **Questionnaire about distraction**

Distraction Investigation

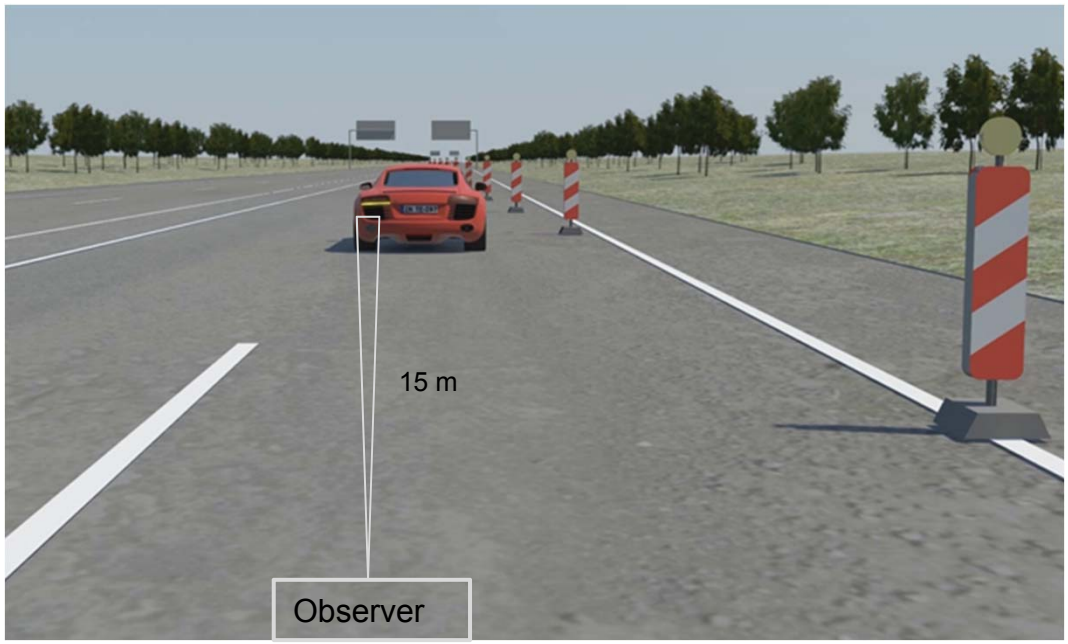
Test Setup

- 10 ten different types of short movies were shown to 54 test persons.
- Situation: A car is driving on the motorway at daytime or nighttime, passing a construction area and with activated direction indicator (with and without dynamic wiping).
- Rating: The situation had to be rated (multiple choice).
- Short interruptions during the movies with different tasks (maths, pictures, etc.) to distract the test persons.

Distraction Investigation:

Analysis of the visual angles from a turn indicator and a series of line poles:

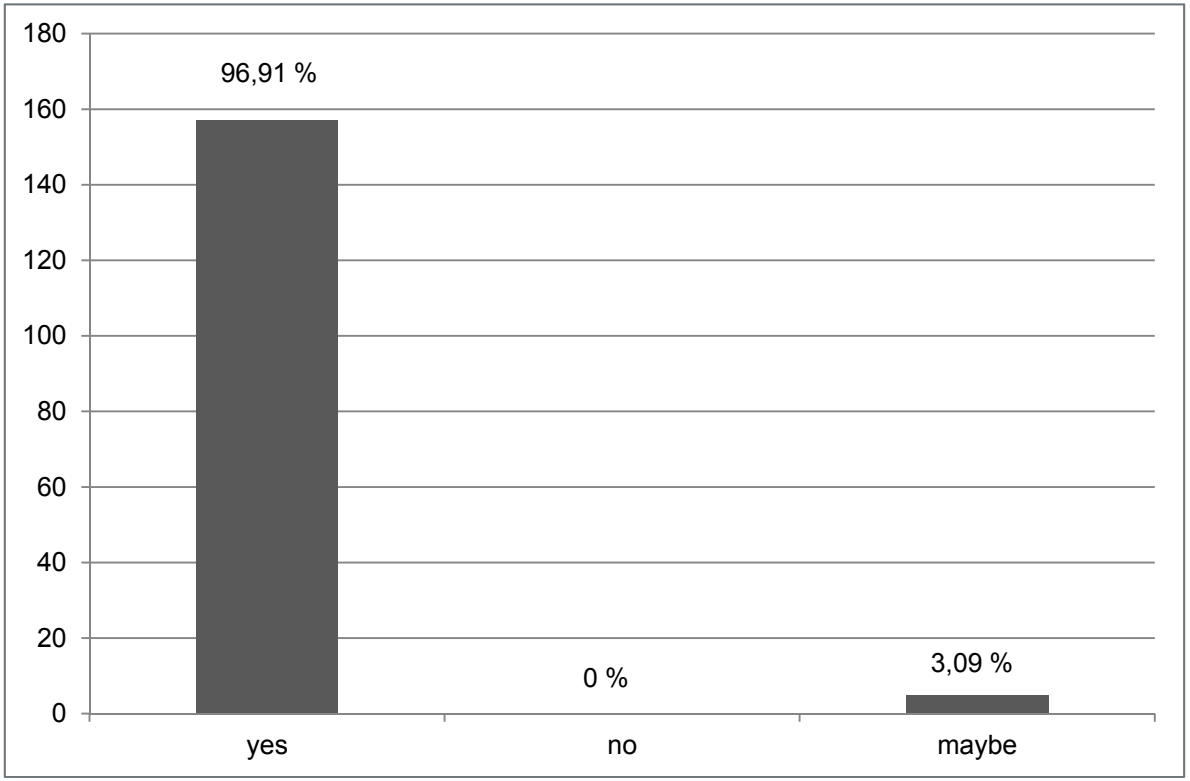
- The turn indicator appears under an angle of **1,14°** for a car **15 meters** ahead.



- The observer needs a distance of more than **125 meters** to see the row of line poles under the same visual angle.

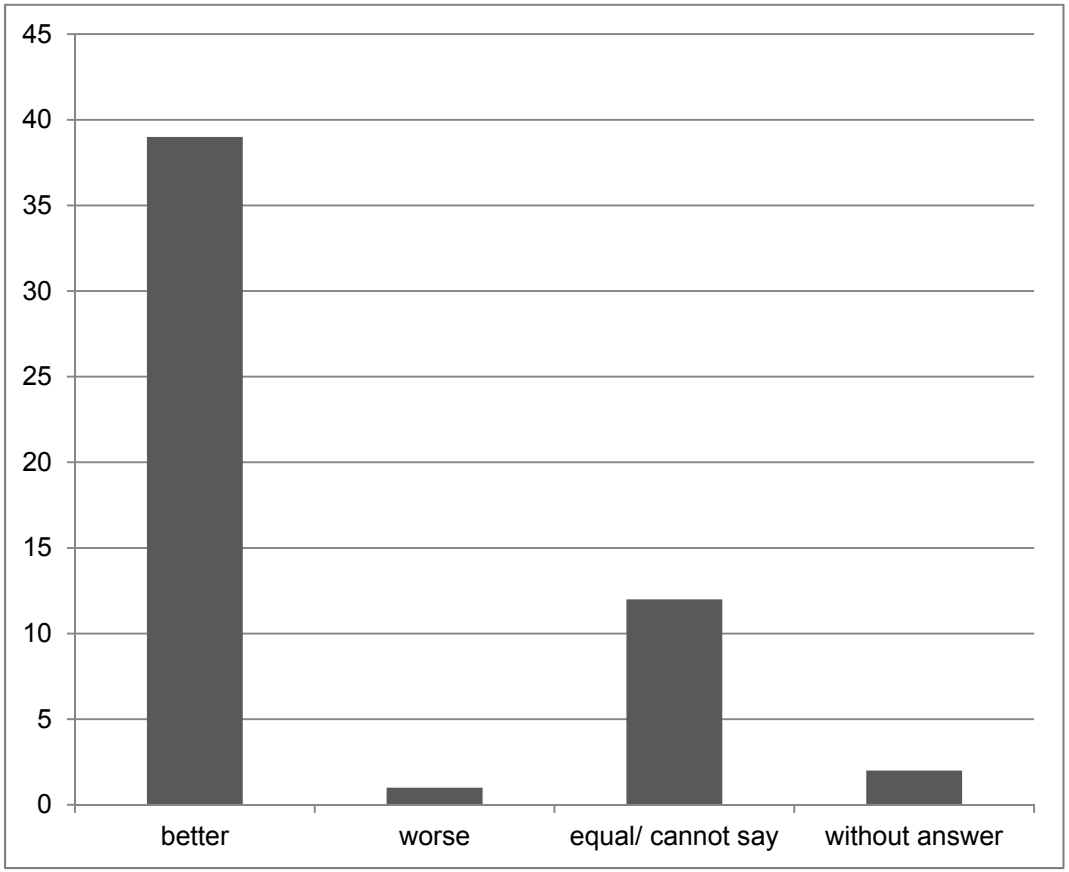
Distraction Investigation: Results

- You can see a driving situation at daytime. Is the situation clearly to understand? (motorway, passing a construction area at nighttime, wiping direction indicator)



Distraction Investigation:

- How do you like the wiping turn indicator (like you have seen in the movies) in comparison to the conventional one?



Research Assumptions, Area of Investigations

During various sessions, lack of research and investigations was stated in GTB/GRE.

Unknown effects (2):

- Distraction from dynamic effects in comparison to other dynamic lights in environment

- Information of the other road users about the turn direction

- Effects of half hidden vehicle, Motorbike etc.

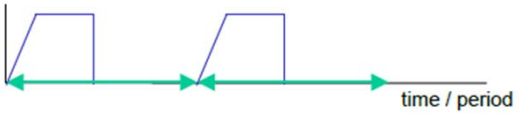
Direction determination and Reaction time on dynamic TI of a „driver“

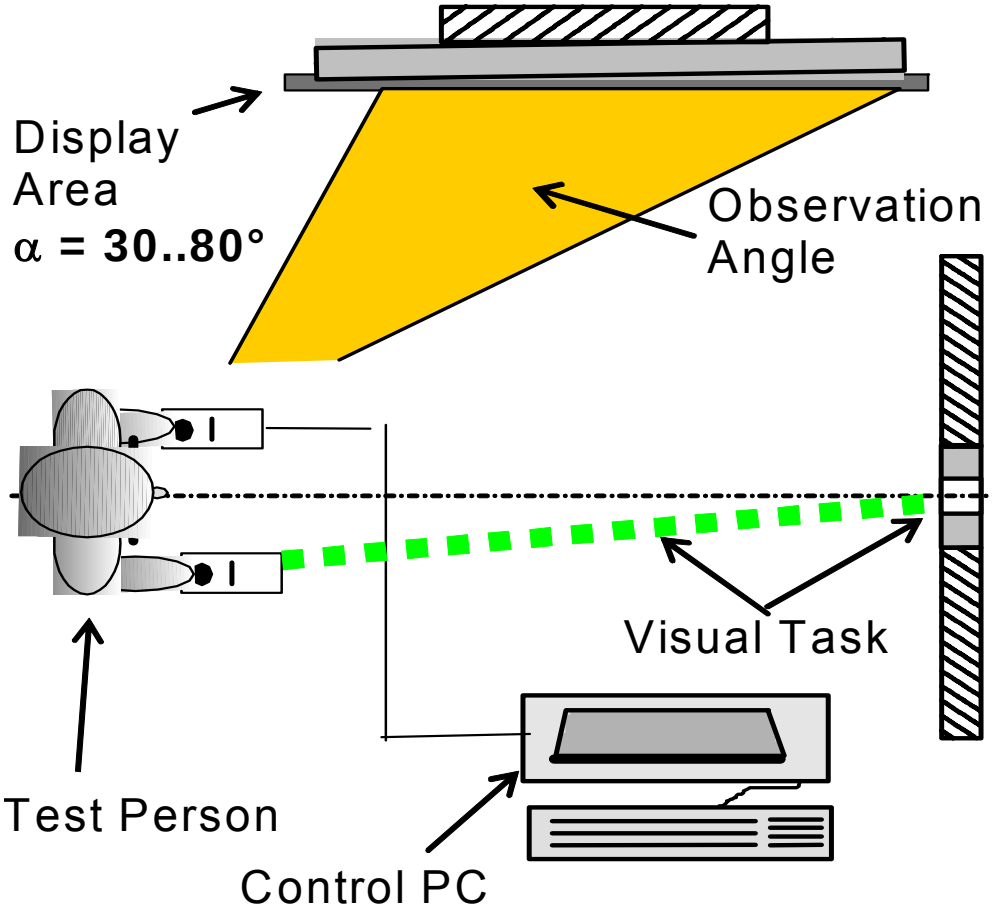
Test conditions

- 27 Test persons positioned in experimental setup
- Configuration displayed a set of Direction Indicators that were activated only once (duty cycle 800 ms, 135 presentations each were performed)
- test persons had to decide whether right or left Direction Indicator was on
- Response and Response time was recorded and evaluated

Test Setup

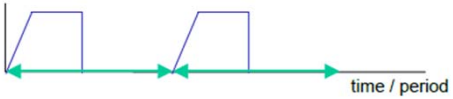
➢ LED prototype with variable intensities indicator

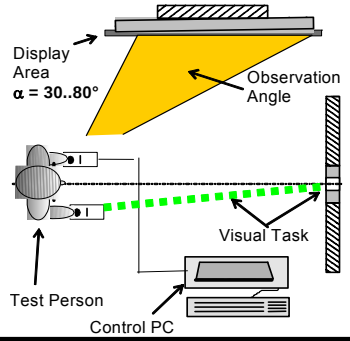




Test Setup
Correct Direction Determination

➢ LED prototype with variable intensities indicator





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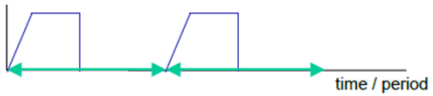
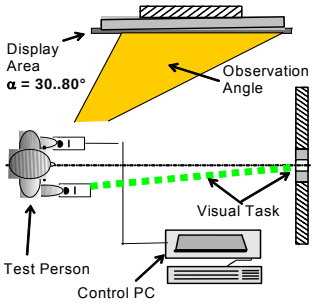
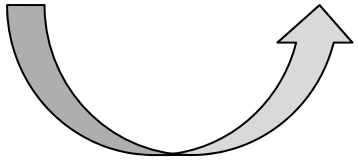
➢ LED prototype with variable intensities indicator





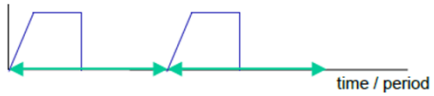
Test Setup
Correct Direction Determination

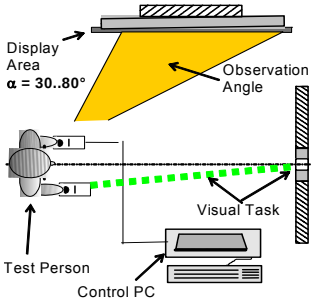
Static Direction Indicator (1cycle;800ms)	Dynamic Direction Indicator (1cycle;800ms)
Correct Answer: 60%	Correct Answer: 84%



The probability to detect the direction after first blinking increased by 24% (absolute), thus by 40% (relative).

➢ LED prototype with variable intensities indicator





Test Setup
Direction Determination
& Reaction Time

- **Test persons: 27**

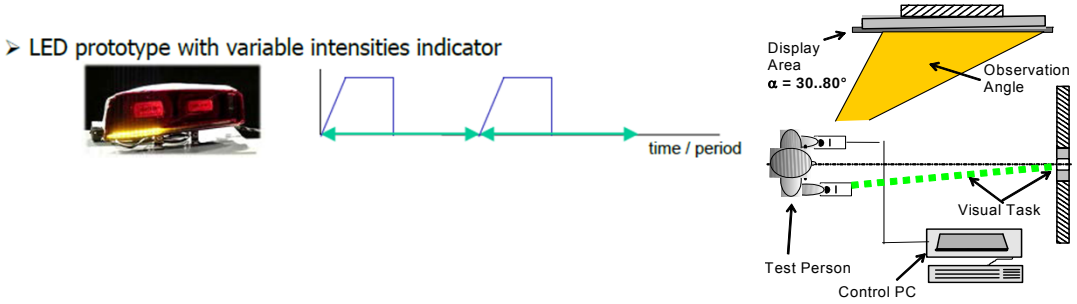
- **Presentation: Three duty cycles, ~ 2,4 sec**

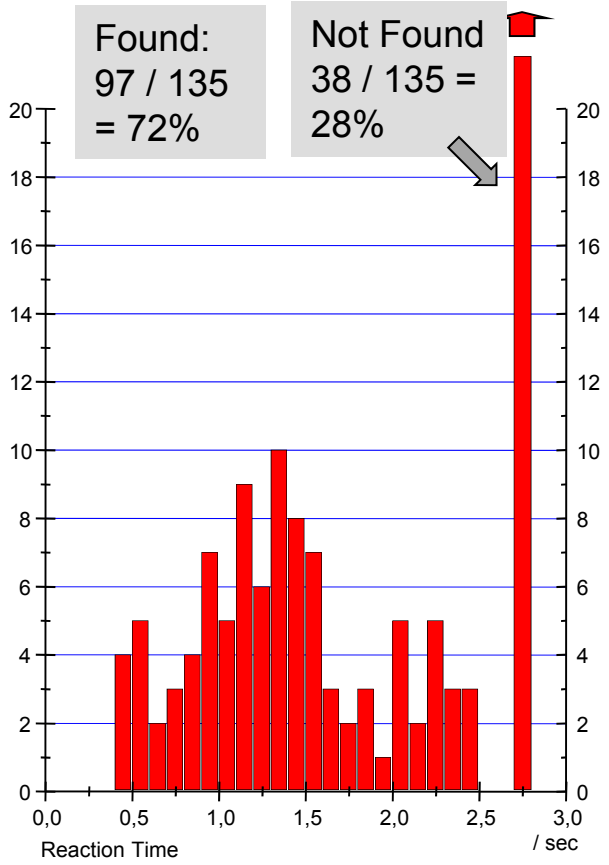
- **Test person target:**
  react after determining the observed correct direction.

- **Failure:**
  If the test persons were unable to react in this time, after the 3rd cycle they were asked to directly look and give the answer. Even though fixation might have needed longer, the results were calculated as 2,8 sec. (2,4sec. plus 0,4 sec. for min. reaction)

Result
Direction Determination & Reaction Time

Static Direction Indicator

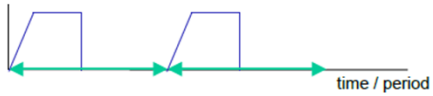


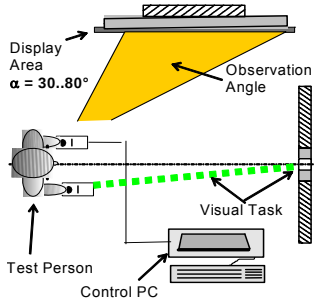


Test Setup
Direction Determination
& Reaction Time

Dynamic Direction Indicator

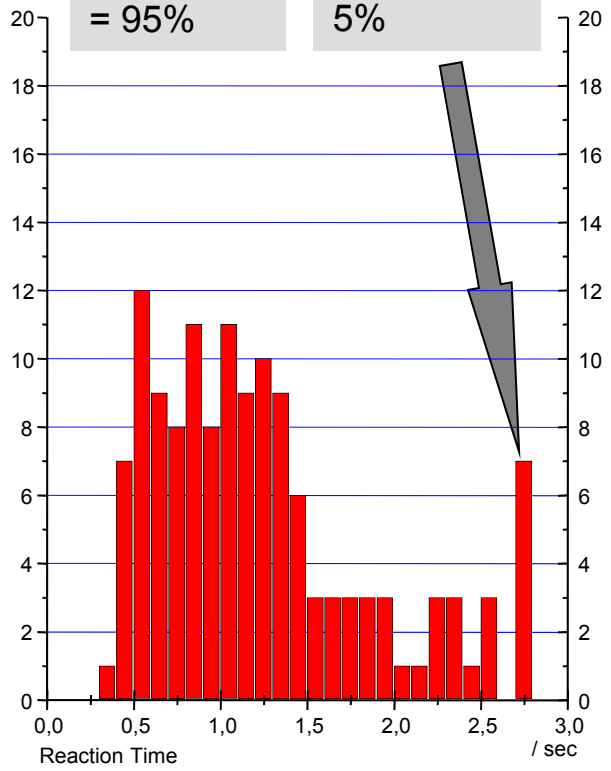
➢ LED prototype with variable intensities indicator





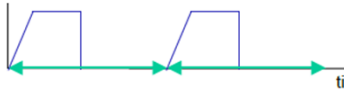
Found:
128 / 135
= 95%

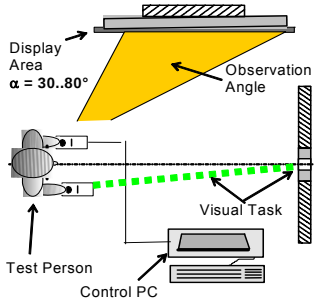
Not Found:
7 / 135 =
5%



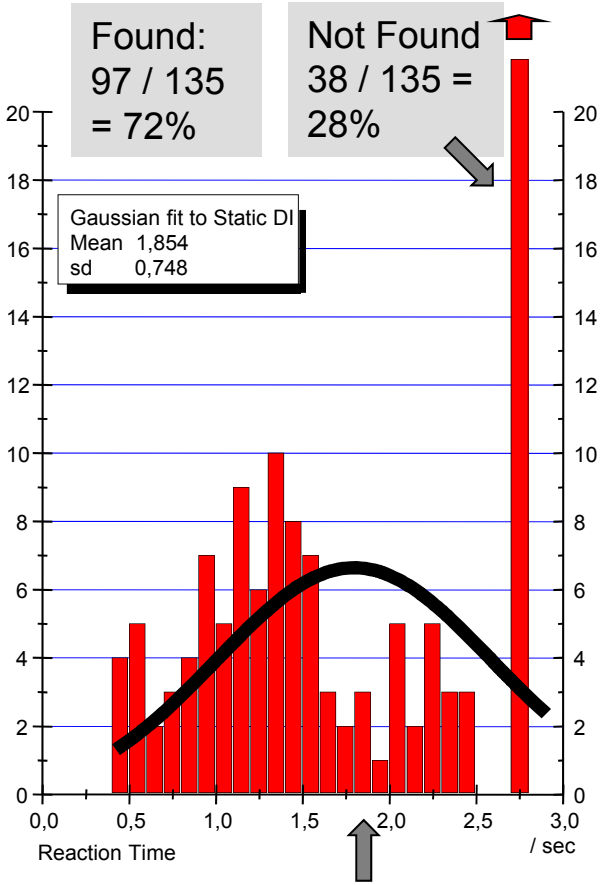
Result
Direction Determination & Reaction Time

➢ LED prototype with variable intensities indicator



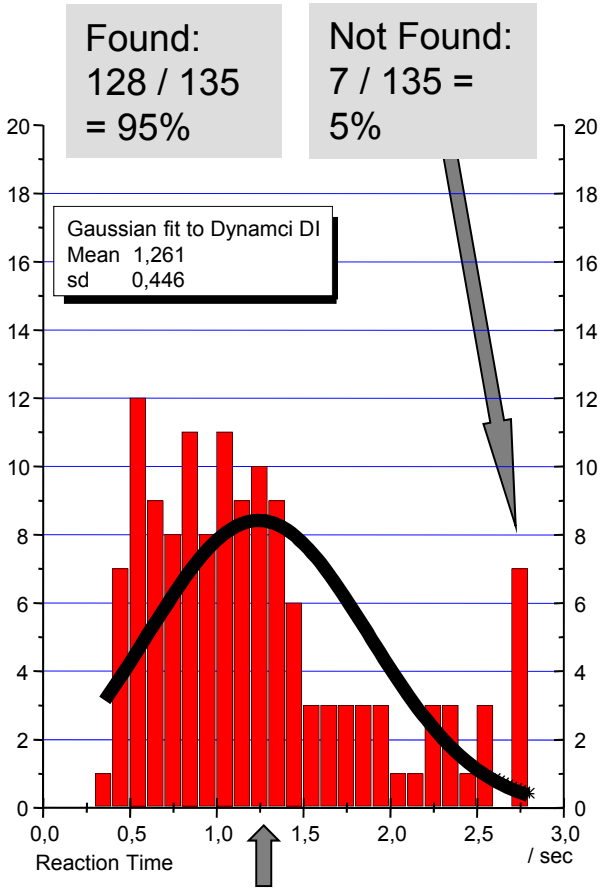


Static Direction Indicator



Avg: 1,854 sec

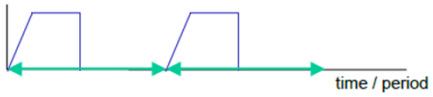
Dynamic Direction Indicator



Avg: 1,261 sec

Summary of Investigations

➢ LED prototype with variable intensities indicator



	Static Direction Indicator	Dynamic Direction Indicator	dynamic vs. static Δ
Questionnaire for distraction: Is Dynamic Better ?			**70%**
1-cycle correct determination of direction	**60 %**	**84%**	**+ 40%**
3-cycle direction found (missed)	**72%**	**95%**	**+38%**
Reaction time 3-cycle for correct determination	**1,854 sec**	**1,261 sec**	**(- 0,593 sec) -32%**

Summary: A dynamic effect (linear wiping) within first 150….200msec. makes a significant difference and shows traffic safety relevant improvements in direction detection and reaction /visual processing speed.

Thank you for your attention!