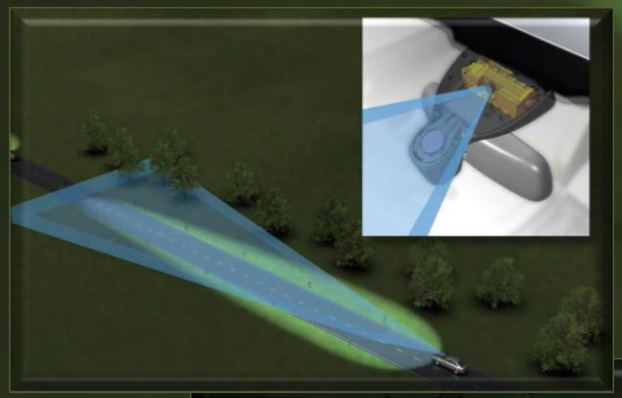
GTB

GROUPE DE TRAVAIL "BRUXELLES 1952"
WORKING PARTY "BRUSSELS 1952"

Automatic Gradual Adaptation of the Main Beam

Introduction of Provisions into Regulations 48 and 123



Presentation to the 62nd Session of GRE
06-09 October 2009

Introduction

Technological progress provides the possibility to produce an adaptive driving beam

Concept and demonstration of prototypes at GRE60 (Oct. 2008)

Informal document for 60th session:

"Presentation by GTB - AFS main beam (driving beam) improvements".

Introduction

Formal Proposals for Amendments

to Regulations 48 and 123 to GRE62

ECE/TRANS/WP.29/GRE/2009/56 (R123)

ECE/TRANS/WP.29/GRE/2009/57 (R48)

These proposed amendments are intended to avoid various interpretations of the existing requirements and consequential debate between the contracting parties regarding acceptability.

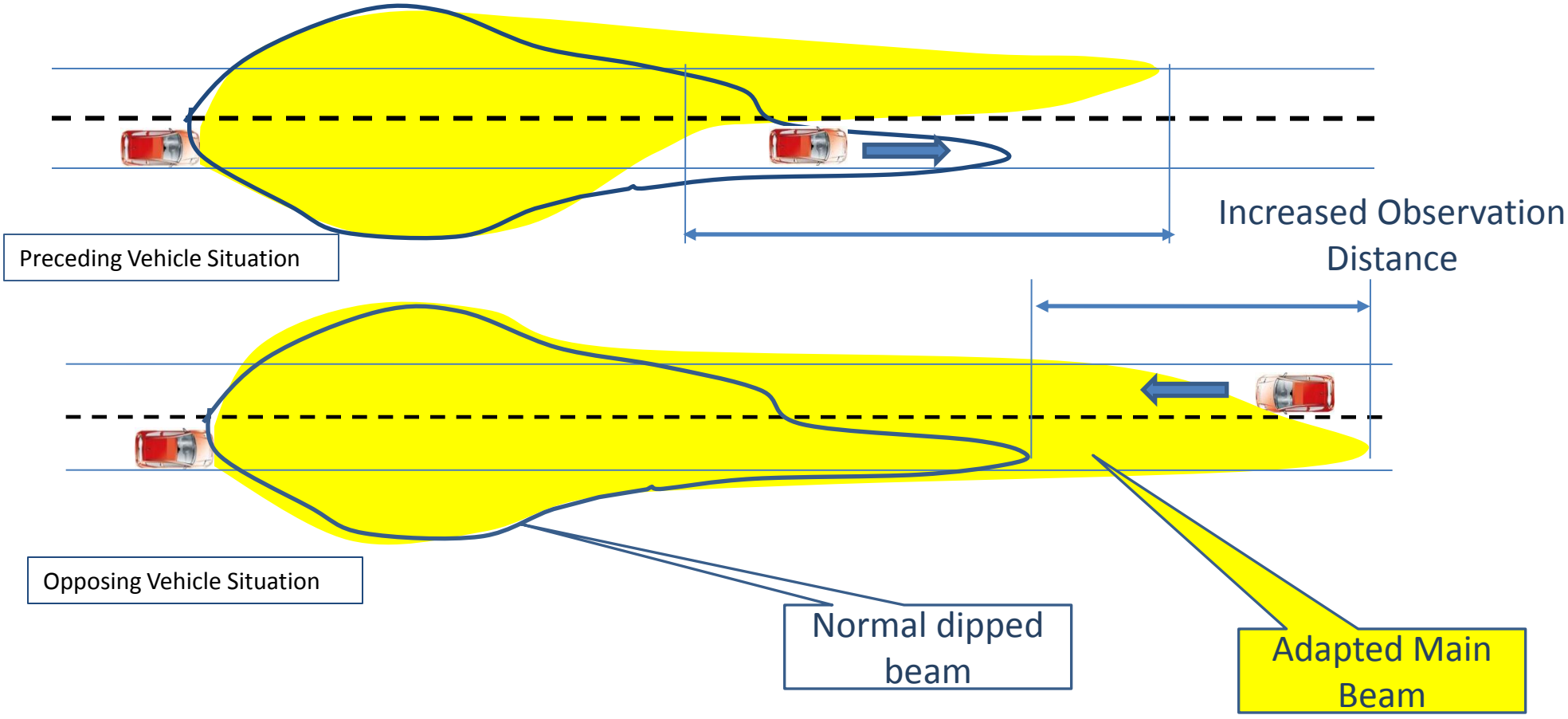
The Problem

How to increase viewing distance without causing discomfort to other road users?

- Dipped beam is only capable of providing limited forward visibility
- Main beam as it exists today glares oncoming traffic in many situations and cannot be used.
- The separation distance between vehicles means that the dipped beam will not provide sufficient forward illumination.
- Drivers have a reluctance to operate the main beam and frequently select the dipped beam too early as recent research by LLAB shows.

The Solution

A system evaluates the road scene ahead of the vehicle and automatically adapts the light distribution according to the position of the preceding and oncoming traffic.



The Adaptive Main Beam

Improved visibility without discomfort to other vehicle users

Optimised use of main beam using an automatic (active) system

Reduces driver fatigue through improved visibility and by reducing the work load BUT the driver remains responsible for deciding when it is appropriate to use the main beam and when to switch to dipped beam

Enhanced detection of pedestrians

SAE Information Report J2829 produced in conjunction with GTB and CIE identifies minimum requirements for the detection of pedestrians and shows that in many cases the dipped beam is incapable of providing sufficient visibility.

Enhanced detection of bicycles

Cycles equipped with good lighting will be detected by the system which will react and adapt the main beam to avoid causing discomfort.
In the case of cycles not having good lighting it is preferable for a driver to be able to recognise them through the use of the main beam even at the risk of causing some glare discomfort.

Enhanced detection of other hazards, e.g. fallen trees, animals

Basic Principles

DRIVER ASSISTANCE

This is a driver assist system to ensure optimum illumination of the forward road scene whilst avoiding discomfort to other vehicle users.

PROVEN RELIABILITY

As with any automatic system, the driver will rapidly become accustomed to it and will be reluctant to manually switch between main and dipped beam. For this reason the system must operate in a reliable manner and suitable objective provisions to ensure this are introduced by this proposal.

DRIVER ALWAYS RESPONSIBLE

The driver remains responsible to ensuring that other road users are not discomforted and is required to switch to the dipped beam as appropriate. At all times the driver is able to manually select either the dipped or the main beam.

OBJECTIVE REQUIREMENTS FOR TYPE APPROVAL

Objective requirements are introduced into Regulations 48 and 123 to ensure that the correct operation of the system is verified during the type approval of the headlamp and also of the vehicle. These requirements take the form of laboratory tests of the headlamp with simulated input signals received from the vehicle and road testing of the vehicle by the technical services.

Objective Requirements

Headlamp Type Approval (Regulation 123):

Verification in Test Laboratory

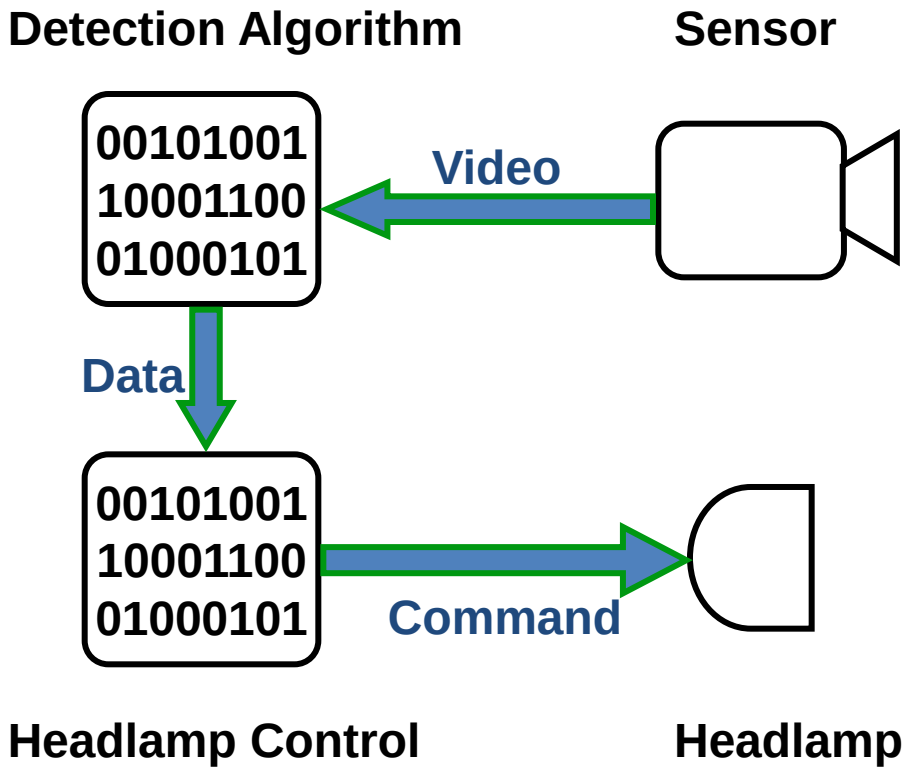
Signal generator simulating the operating modes

Photometric verification of each operating mode in defined zones of the road scene.

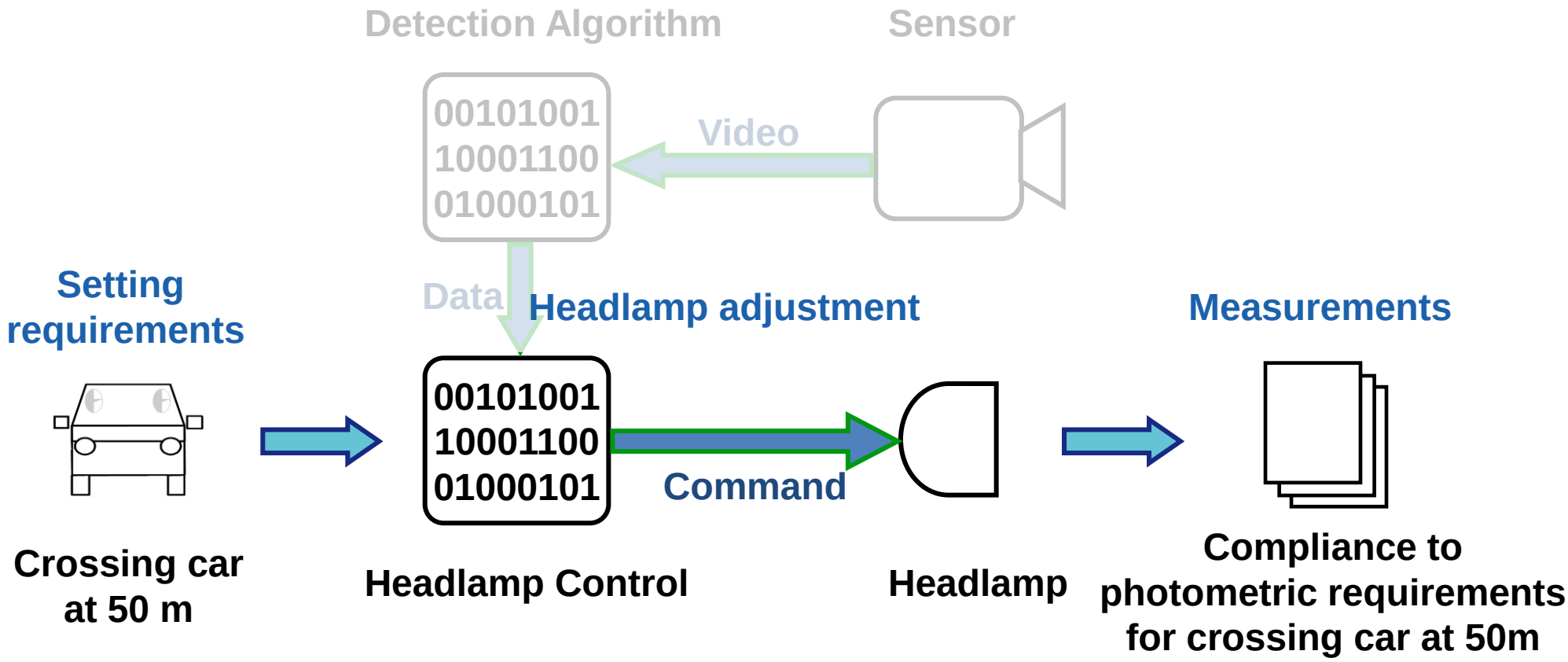
Vehicle Type Approval (Regulation 48):

Test drive according to the requirements of the technical service

System Architecture

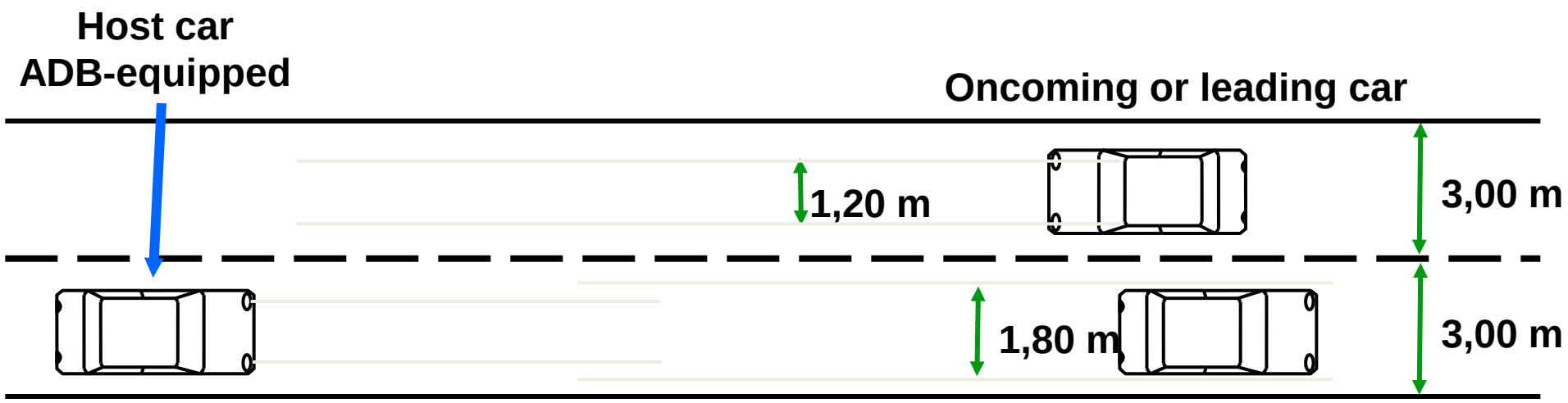


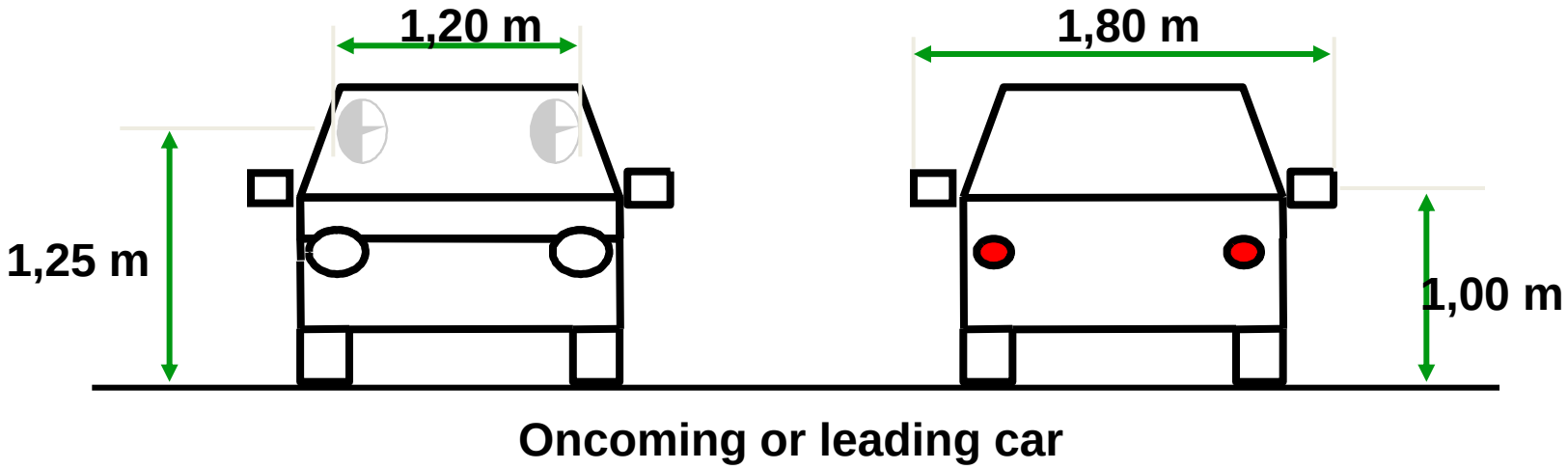
Headlamp Homologation



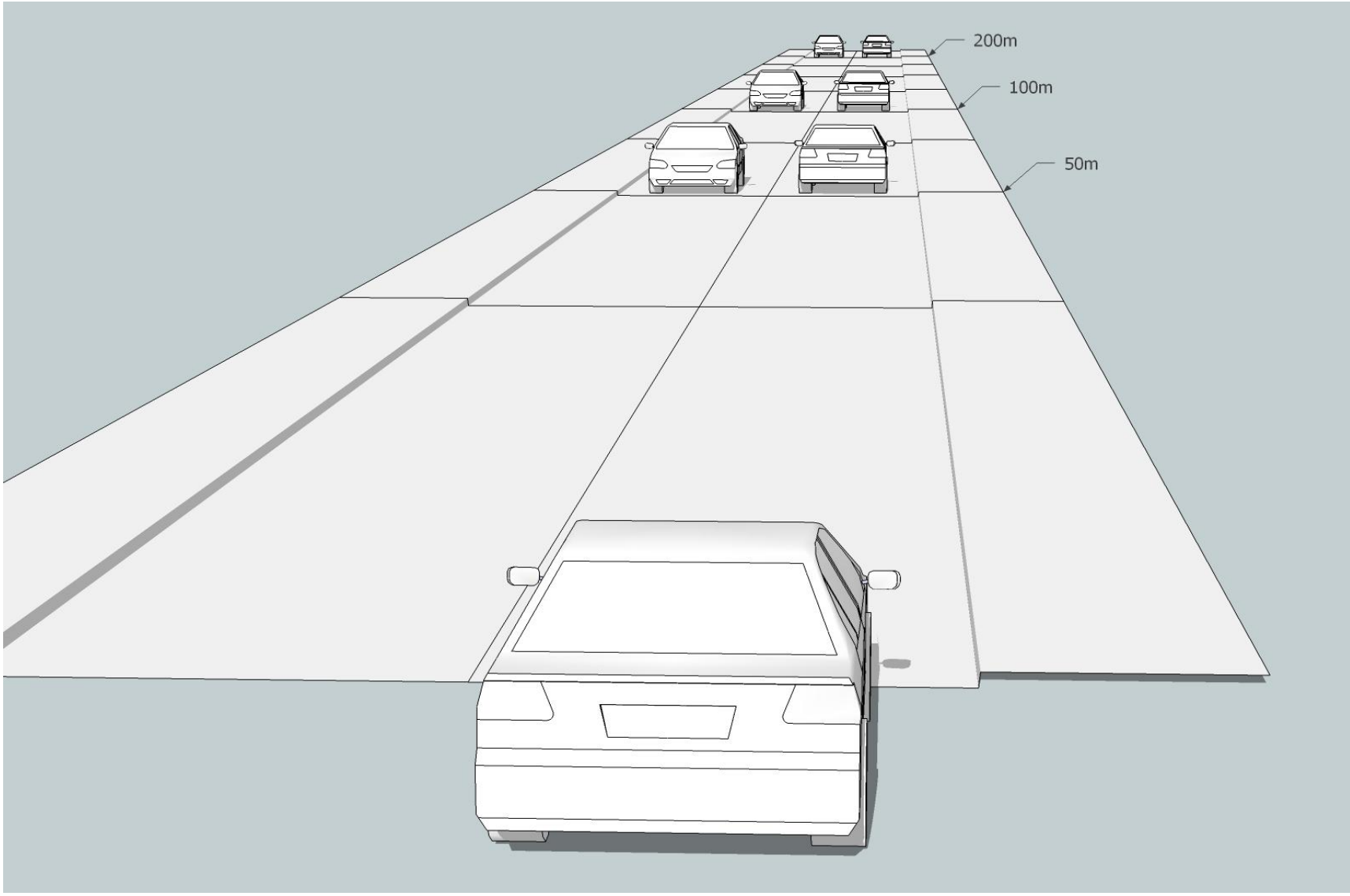
Specification of Test Points (1)

Specification of Test Points (2)





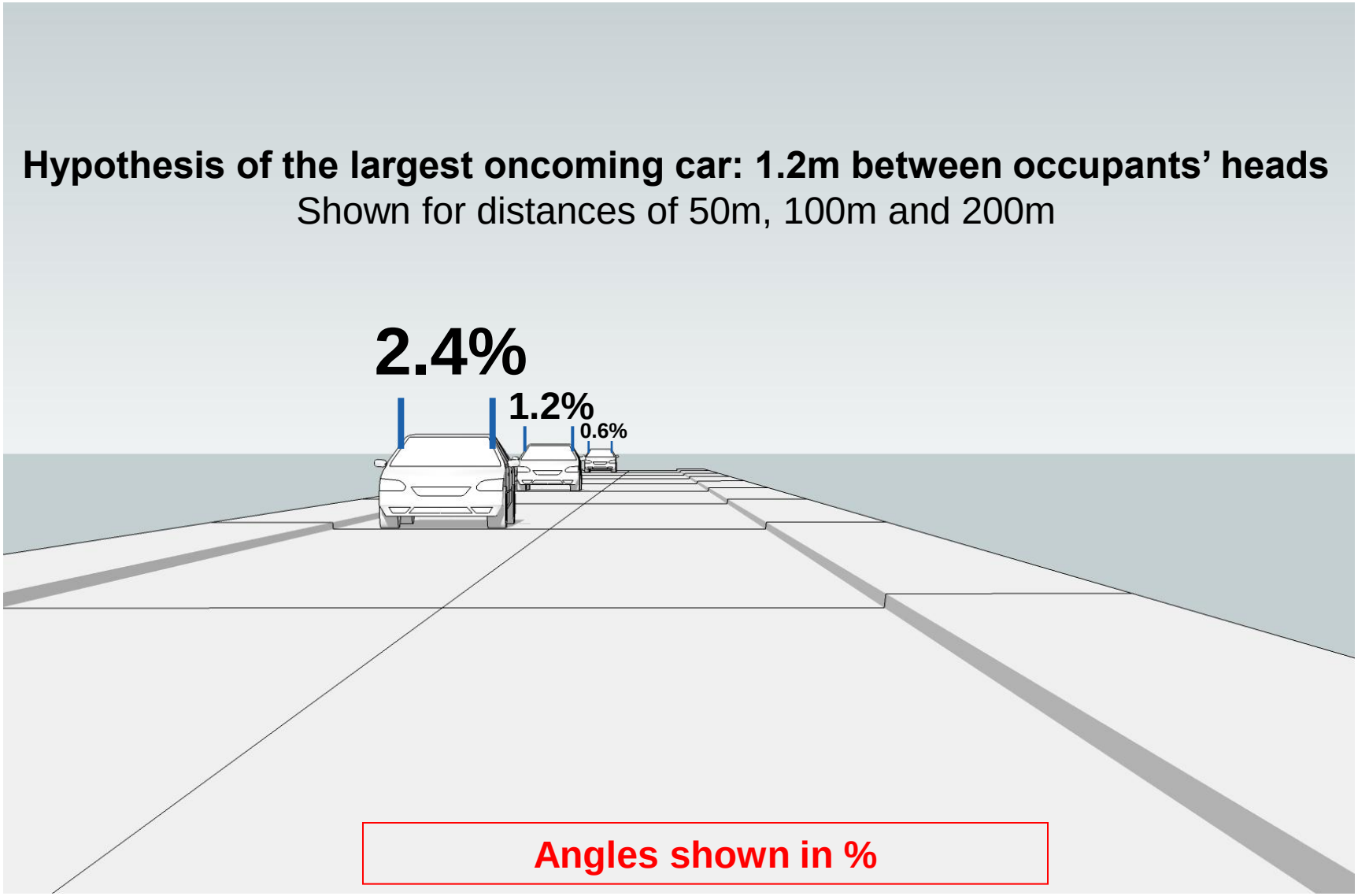
Specification of Test Points (3)



Specification of Test Points Oncoming Car

Hypothesis of the largest oncoming car: 1.2m between occupants' heads

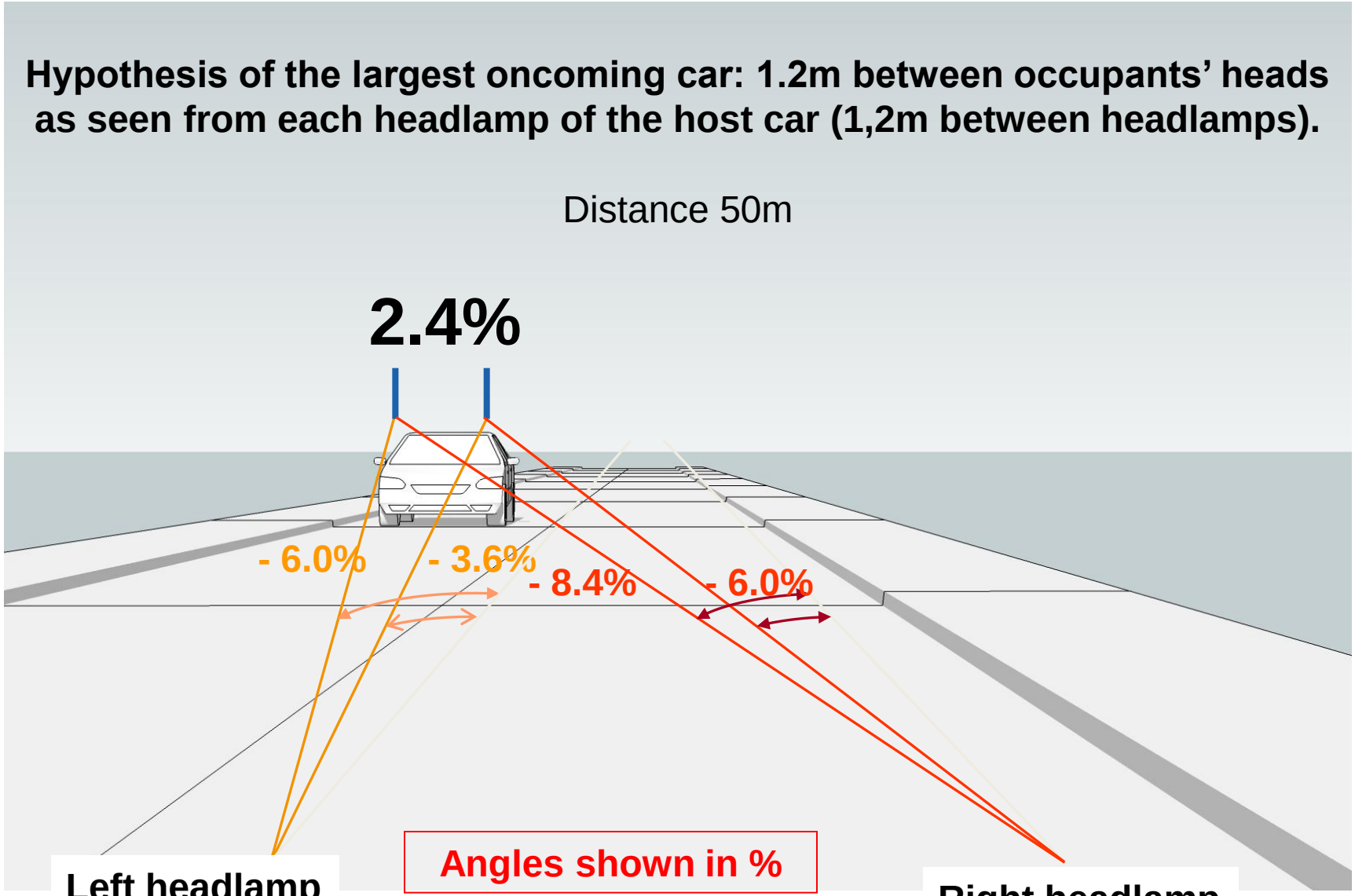
Shown for distances of 50m, 100m and 200m



Angles shown in %

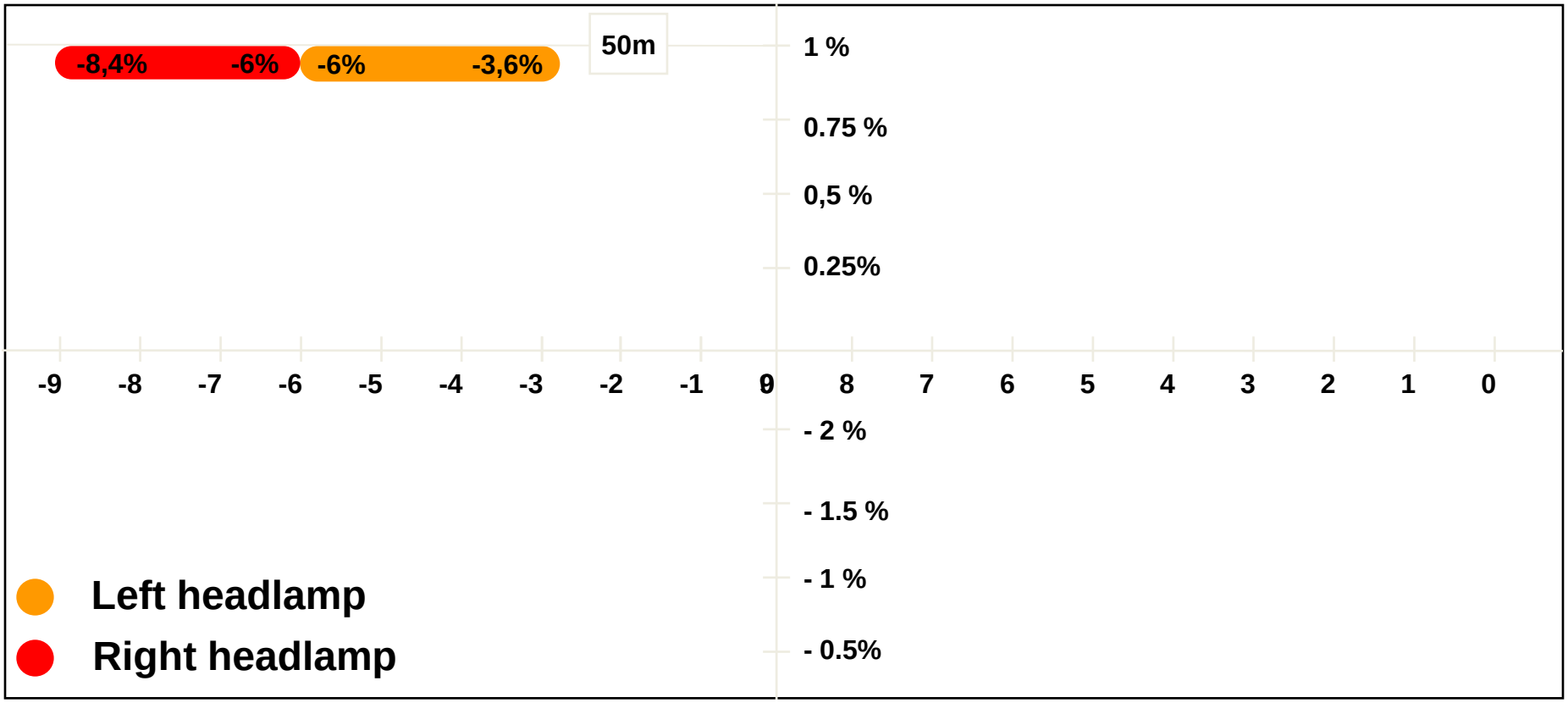
Specification of Test Points Oncoming Car

Hypothesis of the largest oncoming car: 1.2m between occupants' heads as seen from each headlamp of the host car (1,2m between headlamps).



Specification of Test Points Oncoming Car

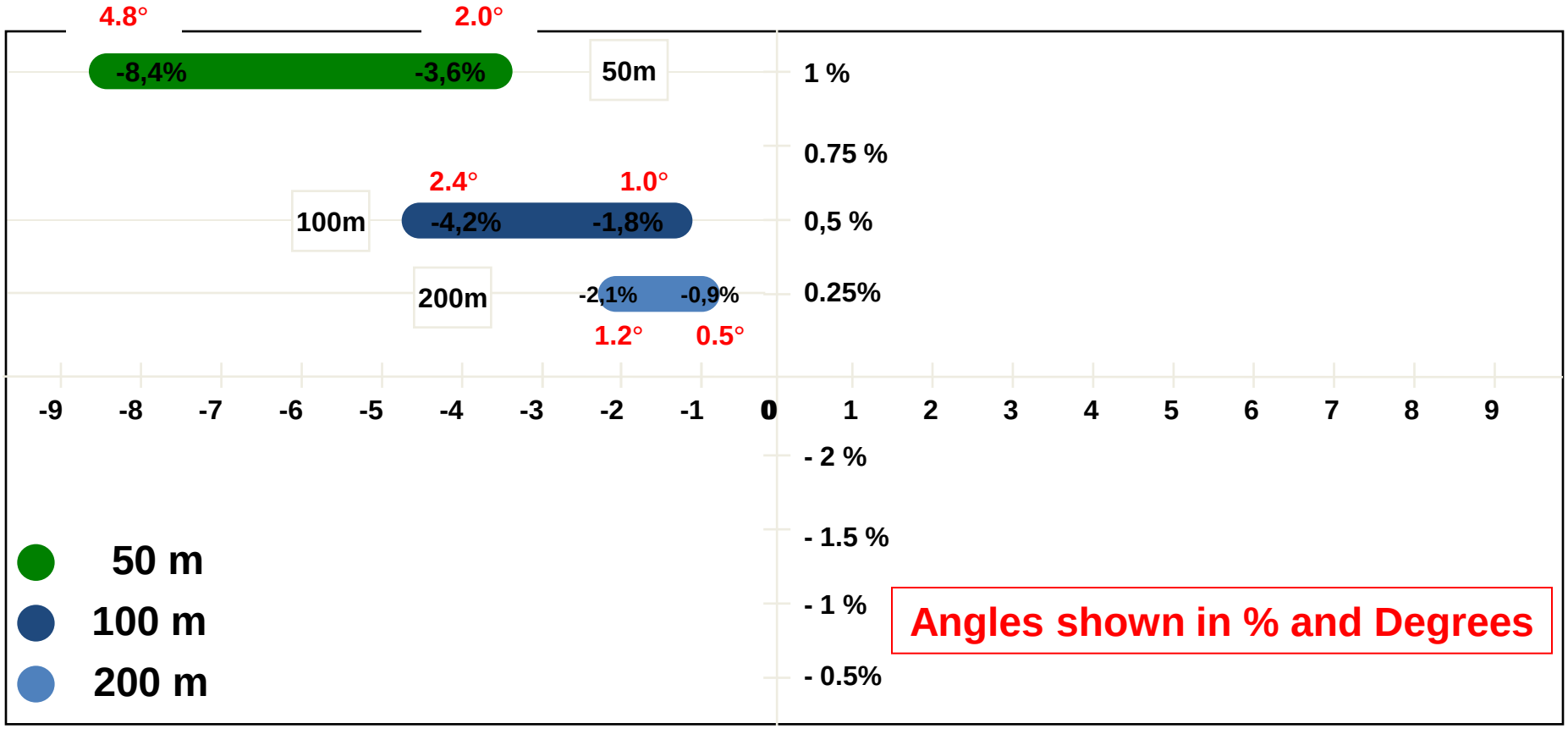
Summary of location of Oncoming Driver's eye positions Distance = 50m



Angles shown in %

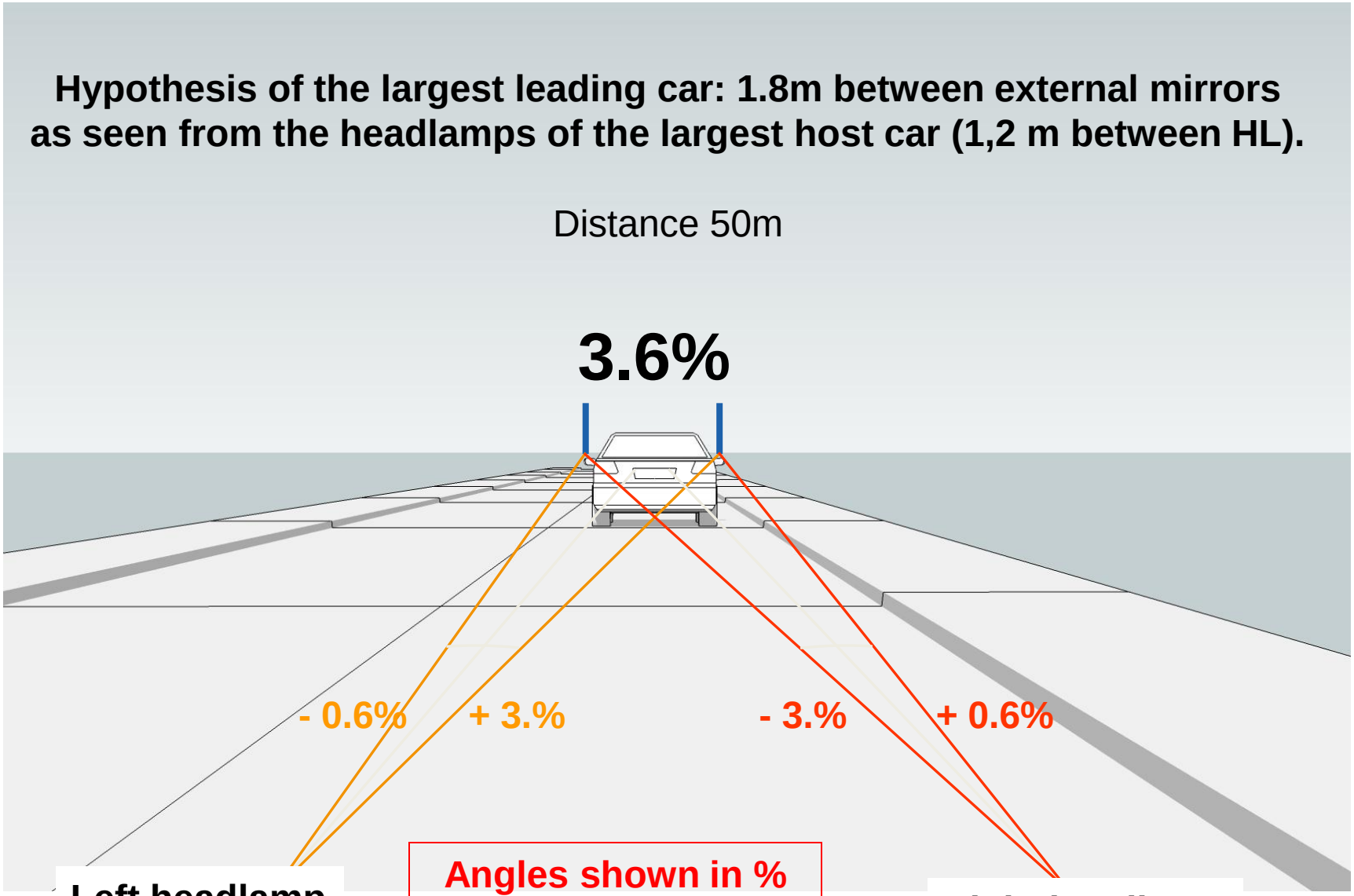
Specification of Test Points Oncoming Car

Combination of Oncoming Driver's eye positions Distance = 50m, 100m, 200m



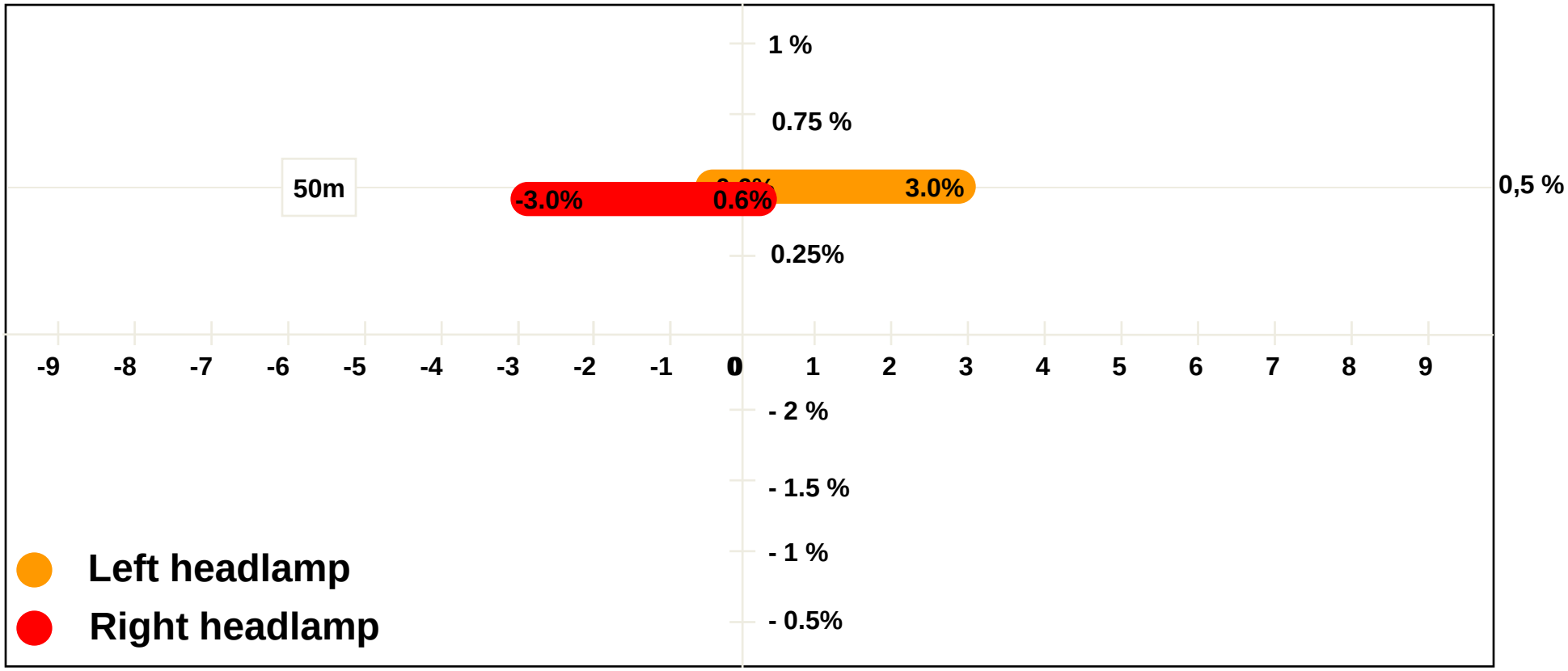
Common requirements for both left and right headlamps.

Specification of Test Points Preceding Car



Specification of Test Points Preceding Car

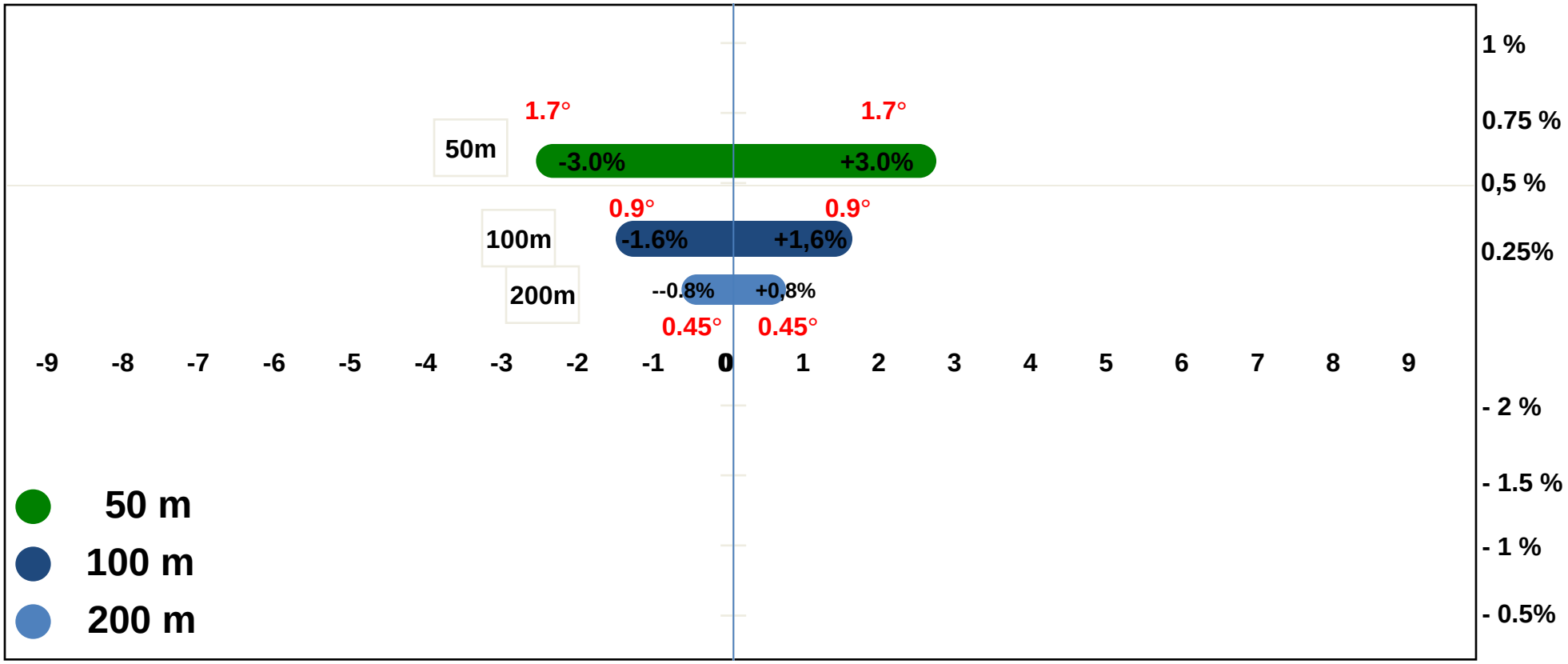
Location of preceding cars mirror positions Distance = 50m



Angles shown in %

Specification of Test Points Preceding Car

Combination of Preceding car positions
Distance = 50m, 100m, 200m



Angles shown in % and Degrees

Acceptable Glare Limits

Based upon B50L value : 0.7 lux max in Regulation 123
(From One Headlamp)

Distance (m)	Illuminance at observers eyes (Lux@25m)	Luminous intensity at observers eyes (candela) one headlamp	
	one headlamp	Oncoming car	Preceding car
50	0,7	440	1320
100	2,1	1300	3900
200	6,1	3800	11400

- **Hypothesis for leading / preceding car**
  - ➔ **Factor 3 linked to rearview mirror and car glazing attenuation**

R123 Photometric Requirements

Maximum values
to avoid discomfort to other vehicle users

Test Point	Position / deg.		Max. Intensity **	
	Horizontal	Vertical	(cd)	(lx)
Line 1 Oncoming vehicle at 50m	4.8°L to 2°L	0.57°Up	440	0.7
Line 2 Oncoming vehicle at 100m	2.4°L to1°L	0,3°Up	1300	2.0
Line 3 Oncoming vehicle at 200m	1.2°L to 0.5°L	0,15°Up	3800	6.0
Line 4 Preceding vehicle at 50m	1.7°L to1.7°R	0,3°Up	1320	2.1
Line 5 Preceding vehicle at 100m	0.9°L to 0.9°R	0,14°Up	3900	6.2
Line 6 Preceding vehicle at 200m	0.45°L to 0.45°R	0.1°Up	11400	18

Each line is tested in conjunction with the signal generator that simulates the activation of the system in response to the presence of a vehicle at the indicated point.

R123 Photometric Requirements

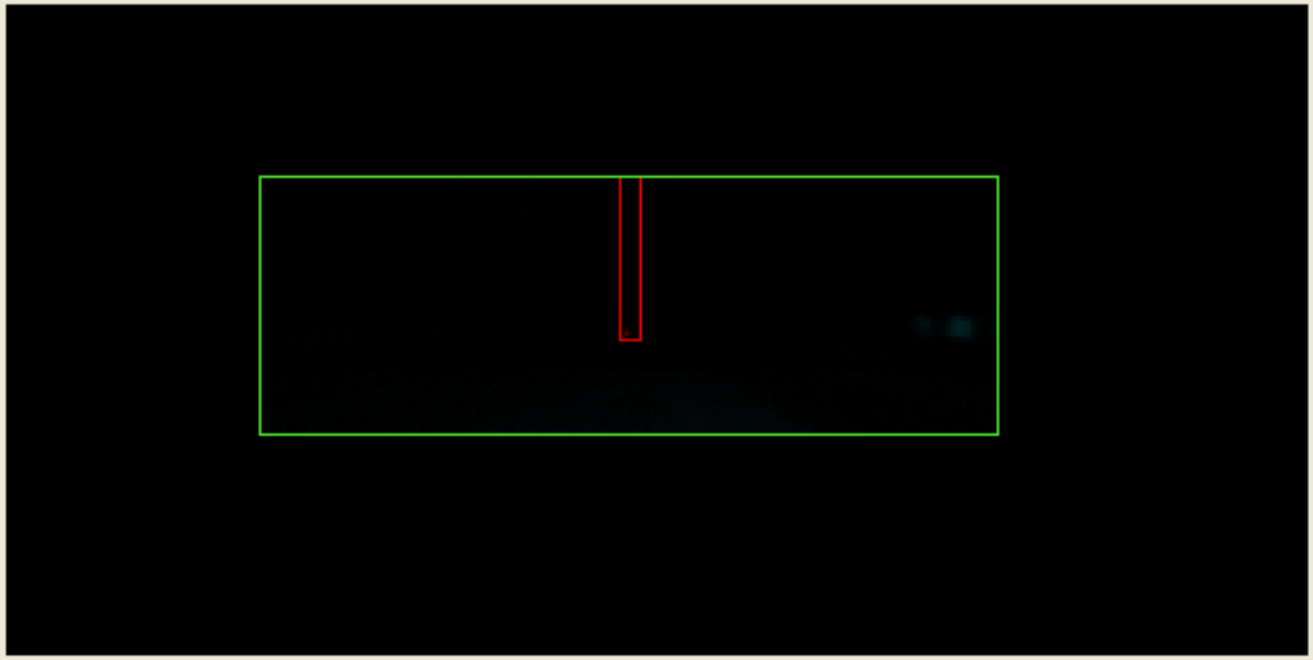
Minimum Values
to ensure sufficient road surface illumination

Test Point	Position /degrees */		Min. Intensity **/
	Horizontal	Vertical	(cd)
50R	1.72 R	D 0.86	3750
50V	V	D 0.86	3750
50L	3.43 L	D 0.86	2625
25LL	16 L	D 1.72	875
25RR	11 R	D 1.72	875

These values are based upon the minimum requirements of the passing beam and are introduced to ensure sufficient illumination of the road surface during adaptation of the driving beam.

In the case that the passing beam, which meets the requirements of paragraph 6.2.,is continuously operated in conjunction with the adaptive driving beam, these photometric requirements do not apply

Sensing and Image Processing



Rec_Distance: 0 m(b)

Rec_IMG_Angle: -1.3 deg(r)

Rec_HL_Angle: 1 deg(g)

Thank you for your attention