GTB Coordinating Committee

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agenda item 5.)

Summary of the GTB Proposal for a Harmonised Passing Beam Specification

Summary of the GTB Proposal

for a Harmonised Passing Beam Specification

This summary uses the content of the paper presented at the 43rd session of GRE

TRANS/WP.29/GRE/1999/18 - 22 July 1999

" RATIONALE OF HARMONIZED PASSING (DIPPED) BEAM PATTERN"

It presents an explanation of the proposal in the context of the changes relative to the current ECE requirements. The proposed values are based upon the use of light sources operating at rated luminous flux and specify values for type approval.

The consideration in GRE is in relation to ECE regulation and for this reason this paper does not discuss the changes relative to FMVSS108. When required, a similar explanation based upon the US requirements can be produced.

Summary of the GTB Proposal

for a Harmonised Passing Beam Specification

Please note that this paper only considers the parts of the Harmonised Passing Beam specification in the region of the cutoff. It is this area which will determine the efficiency of forward visibility for the driver and the effects of glare to the opposing vehicle.

For a full explanation of the proposed test points and values please refer to

TRANS/WP.29/GRE/1999/18 - 22 July 1999

" RATIONALE OF HARMONIZED PASSING (DIPPED) BEAM PATTERN"

The Task

To propose a Harmonized Beam Pattern that:

a) Improves safety by offering better (or at least maintaining the present level of) driver visibility

b) Accommodates the present systems and headlamp construction principles of European, Japanese, and U.S. headlamps.

c) Establishes a dipped beam pattern which gives a good balance between adequate illumination for visibility and low illumination to control glare for oncoming traffic.

The Task

To consider illumination for visibility:

Cover the following main target areas:

Road in front of the vehicle

Road markings

Targets on or along the road

Areas straight ahead, also right and left

Signs, both along the road and above the roadway

The Approach

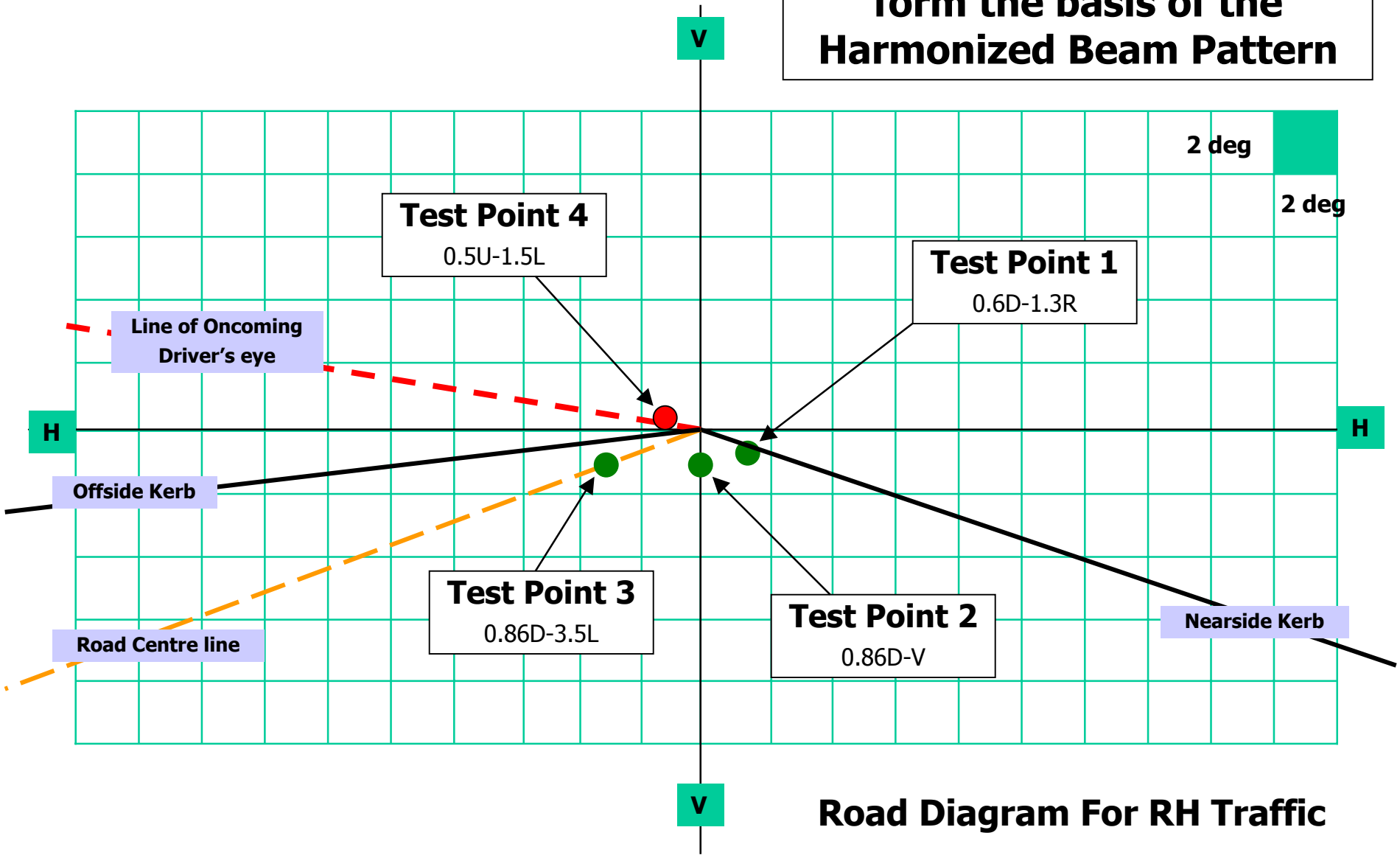
The Coordinating Committee

a) Prepared a bibliography of 94 technical papers relating to dipped beam headlamps.

b) Commissioned a research study by the University of Michigan Transportation Research Institute and recommended 4 common test points to form the basis of the harmonized beam pattern.

Test Point 1	0.6D-1.3R
Test Point 2	0.86D-V
Test Point 3	0.86D-3.5L
Test Point 4	0.5U-1.5L

4 Common Test Points to form the basis of the Harmonized Beam Pattern



Road Diagram For RH Traffic

Note

All intensities listed are based on the ECE system:

i.e. Type Approval values in Lux at 25m

using reference luminous flux (at approx. 12.0 V)

Preamble

From a human factors standpoint:

It is preferable for the driver to have his eyes focused as far down the road as possible to be able to maintain his lane position and recognize / react to objects and pedestrians on the road.

In daylight, drivers focus their eyes several hundred feet ahead of the vehicle. It is important, therefore, to have the maximum intensity of the beam pattern relatively near the horizon and to have uniform luminance in the foreground.

There is a reduction of driver performance when the eye position is guided toward excessively high or patchy foreground illumination. The driver must have sufficient time to prepare for his actions; to see the road and the possibility of any obstacles on or near the road.

Preamble

The highest practical output of the headlamp in combination with the lowest possible oncoming glare (or any other veiling light) should produce the best forward visibility

Allowed glare limits must be set to:

a) Allow illumination of overhead signs

b) Provide ability to see different visibility objects

i.e. For any increase in visibility, the level of forward illumination must be increased.

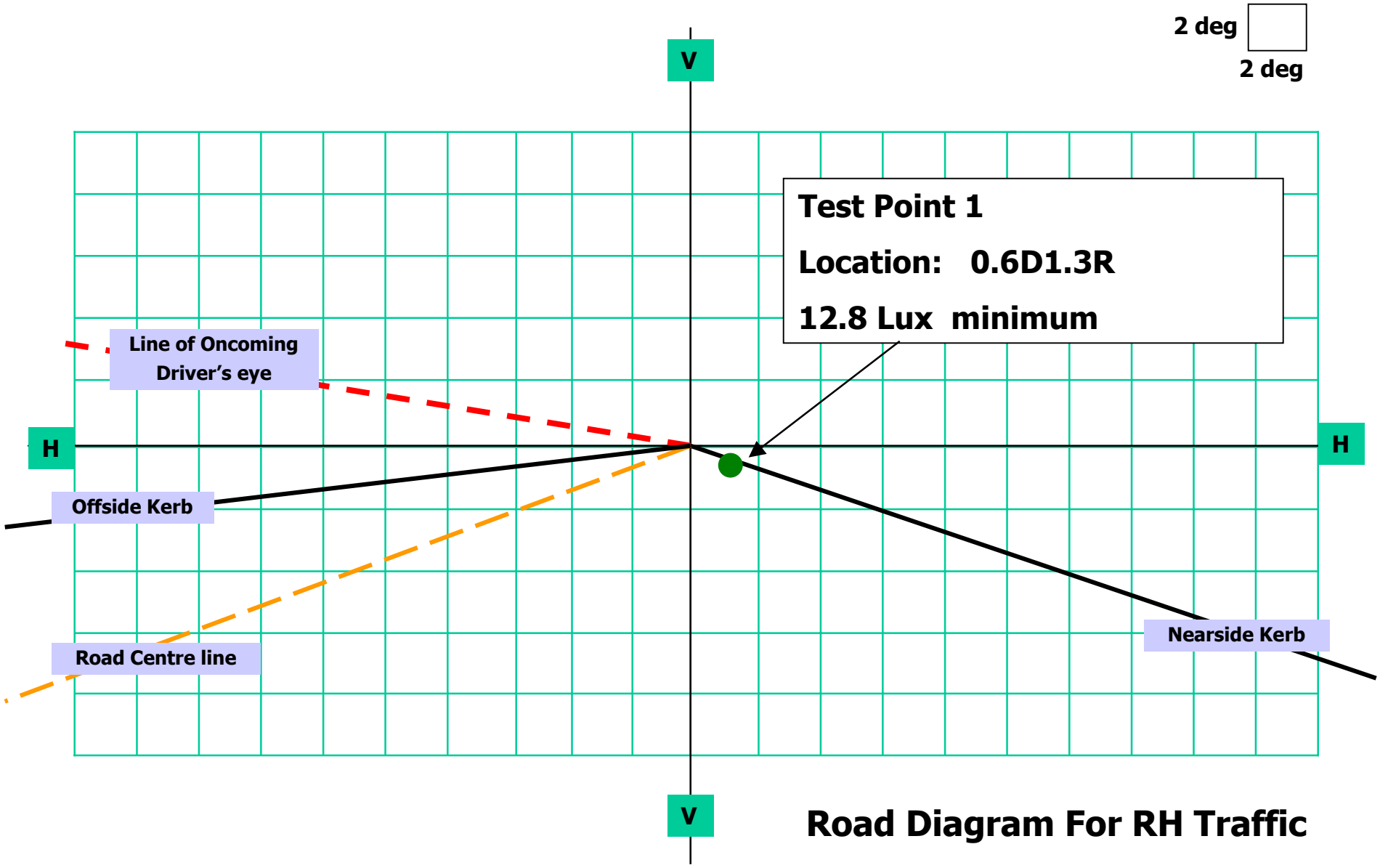
Where the ratio between the forward illumination and the opposing glare/veiling glare/ambient light is the highest, we can expect the best overall visibility under glare conditions.

Proposed Test Points

Test Point 1

Location:	0.6D-1.3R	
Required Illumination:	12.8 Lux minimum	
Purpose:	Controls the position of the high intensity portion of the beam down the road, and particularly along the right road edge.	
Closest test point:	U.S. FMVSS 108	0.5D-1.5R with a value of 12.8 Lux
	ECE	0.57D-1.14R with a value of 12.0 Lux

The proposed value for this point would represent a slight improvement in visibility illumination for the U.S., ECE, and Japan.



Road Diagram For RH Traffic

Proposed Test Points

WIDE SPREAD

The vehicle lighting system must provide adequate illumination for the critical nighttime driving tasks of

Vehicle guidance

Obstacle detection

Recognition of traffic control devices

Driving on winding country roads places greater demands on the light available for vehicle guidance and obstacle detection through turns.

Damasky, concluded in his report on Geometry of the Road Area and Effects on Motor Vehicle Lighting that "Wide illumination is also practical in order to allow the course of the road to be recognized within sufficient time on curvy roads."

It is also important and helpful for wide spread light to increase the peripheral detection for the driver's guidance on the road.

Proposed Test Points

WIDE SPREAD

Sufficient lateral spread is essential for safe visual performance on sharp curves and at intersections.

Wide spread angles are warranted to provide adequate illumination for guidance through turns and under conditions of poor forward visibility such as fog, snow and rain.

A survey of 119 of the world's lighting experts conducted and published in 1993 by Sivak and Flannagan, from the University of Michigan, found that of 16 visual-performance functions, lateral spread was considered the sixth most important

The most important functions were:

Right-side targets

Oncoming glare

Foreground

Left-side targets

Signs on the right shoulder

Lateral spread.

Proposed Test Points

Test Points 6

Position: 2D-15L & 2D-15R

Required illumination: 1.28 Lux Min

Purpose: Control illumination into the area between 20 and 30 meters down the road and out 4 to 5 meters to either side of the road.

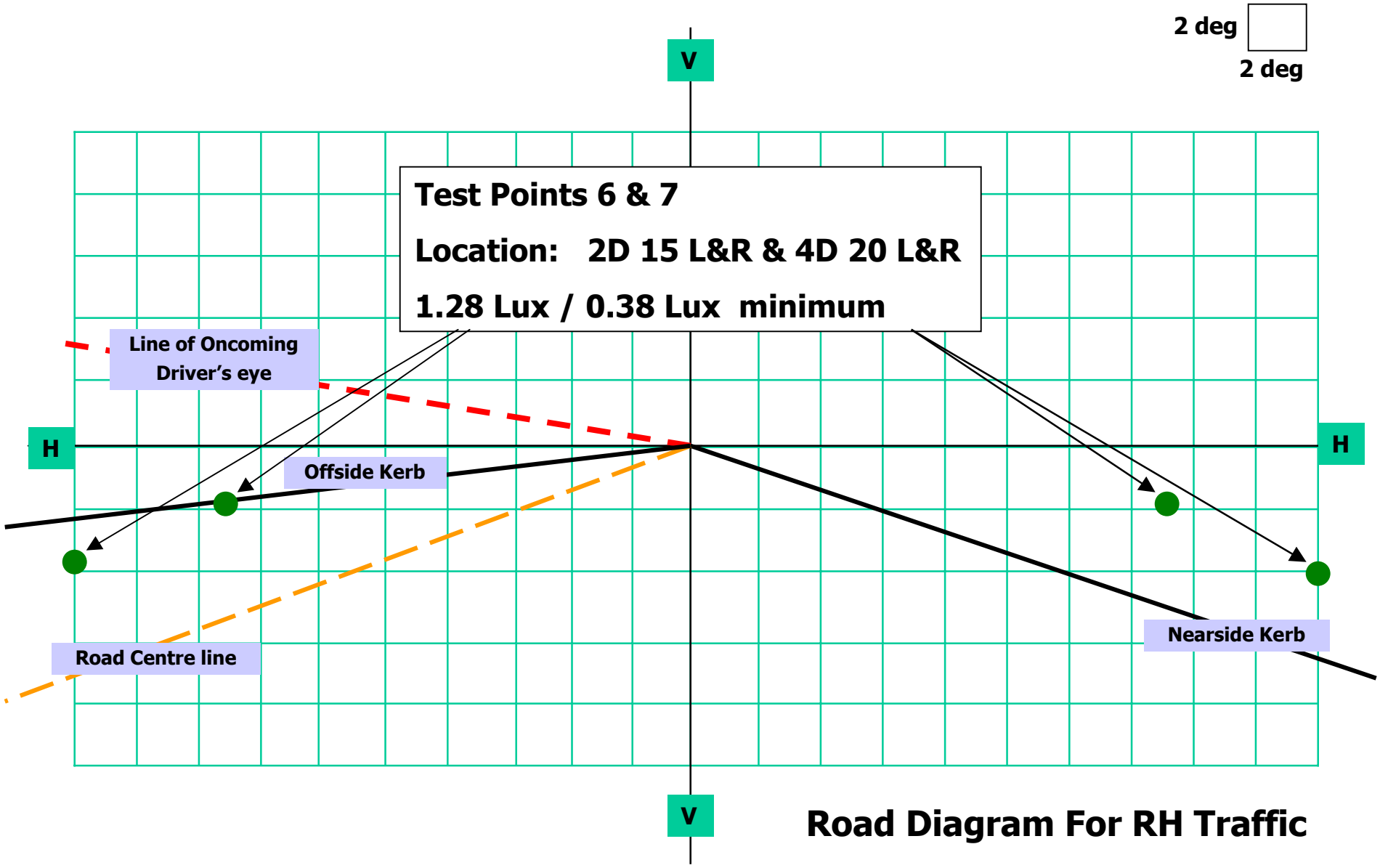
Test Points 7

Position: 4D-20L & 4D-20R

Required illumination: 0.38 Lux Min

Purpose: Control illumination into the area between 8 and 20 meters down the road and out 3 to 4 meters to either side of the road.

Together, these points cover the area that needs to be illuminated to provide guidance and obstacle detection during sharp turns and adverse weather conditions that reduce down road visibility. The values chosen provide sufficient light for the guidance function of headlamps.



Road Diagram For RH Traffic

Proposed Test Points

LIGHT ABOVE THE HORIZONTAL

The importance of the control of light above the horizontal has been recognized by all of the Committee members.

Test points, lines, and zones are in the beam pattern to provide glare limits and minimum sign light requirements.

Illumination of overhead signs, referred to as "sign light" has also been covered in the beam pattern by Test Point 9 and the eight sign light test points.

While the sign light test points are now in the ECE Regulations and in FMVSS 108, there are some revisions in this proposal from the present regulations.

Proposed Test Points

Test Point 4

Replaces the existing B50L (0.57U-3.43L) now in the ECE Regulations.

Position:	0.5U-1.5L, (one of the four common test points)
Required illumination: :	1.07 Lux max
Closest ECE test point:	B50L - 0.57U-3.43L (0.40 Lux max)
	Zone III (0.70 max)

The associated distance to the opposing driver's eye-point is also increased (0.5U-1.5L is closer to H-V, than B50L (0.57U-3.43L)).

Proposed Test Points

Test Point 4

The required illumination value of 1.07 Lux maximum is far below the value recommended by Alferdinck, as a reasonable maximum value at this point (2.19 Lux).

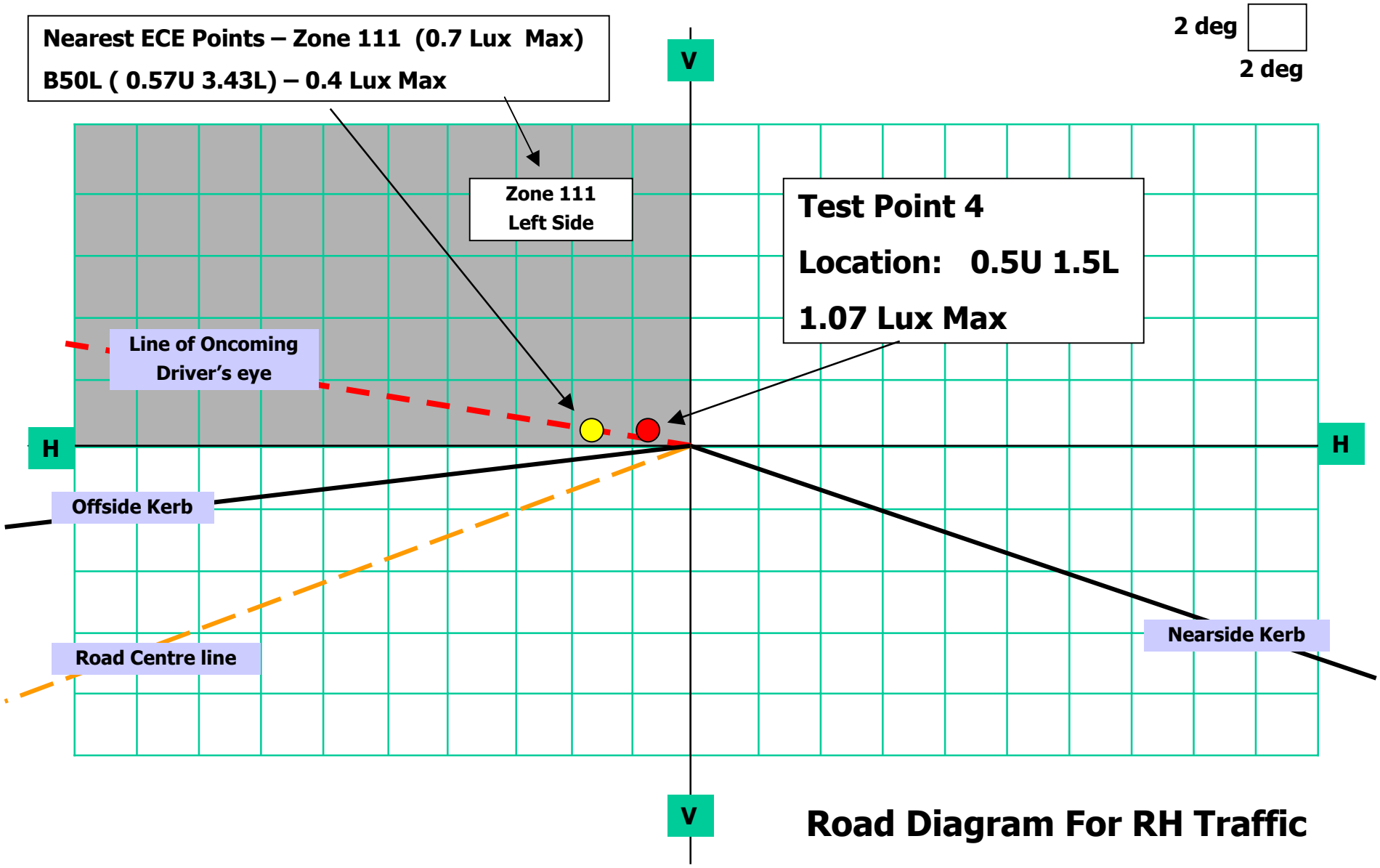
The actual headlamp beam pattern intensity decreases as the test point moves to the left from the vertical line and as the test point moves up from the horizontal line.

The maximum regulation value of 1.07 Lux at 0.5U-1.5L is practically unchanged from 0.70 Lux at B50L (0.57U-3.43L).

An approximate conversion from a test point at 1.5L to a test point at 3.43L is 40% (the exact number depends on the headlamp bulb being used and the accompanying beam pattern).

0.7 Lux x 1.4 = 0.98 Lux

During actual driving situations; hills, curves, and turns; the location of the opposing drivers' eye-point changes. A compromise has to be made to select one point for testing.



Road Diagram For RH Traffic

Proposed Test Points

Zone 1, Zone 2, Zone 3 and Line 14

Essentially equivalent to Zone III (0.7 Lux max) of the present ECE Regulations.

Zone 1 (1U/8R-4U/8R-4U/8L-2U/8L-1.5U/6L-1.5U/1.5L-0/1R-0/4R-1U/8R) has a maximum value of 1.07 Lux

Zone 2, directly above Zone 1, allows a general maximum of 0.4 Lux with a very localized maximum (2° conical angle) of 0.96 Lux.

Zone 3, directly above Zone 2, allows a general maximum of 0.2 Lux with a very localized maximum (2° conical angle) of 0.64 Lux.

The eight sign light test points contained in or near Zone 1 provide the only minimum requirements in or near Zone 1

Line 14 from 10U to 90U provides control of uplight that would be detrimental in fog or snow conditions. This new line has a maximum value of 0.16 Lux. This limit will provide improved visibility to the driver in fog or snow.

Proposed Test Points

Test Point 9

Provides another sign light requirement which has been added at 0.5U-2.0R.

The minimum value of 0.76 Lux is increased from the value of 0.64 Lux (converted to 12.0 v) contained in FMVSS 108. This will provide improved visibility for right road side retroreflective signs.

The maximum value of 3.2 Lux, is decreased from the value of 3.45 Lux (converted to 12.0v) now in FMVSS 108, and is specified to help control glare in this area.This also helps control the light directly below Zone 1 which is only 1.0° away in the vertical direction with a maximum limit of 1.07 Lux.

Proposed Test Points

Test Point 8

Position: H-V

Required Illumination: 1.92 Lux Max

Zone 1 includes most of the area of the possible eye-point locations of opposing drivers. There is some percentage of time when eye-points will be at the H-V location.

In flat straight roads the opposing drivers' eye-point at H-V will be at a long distance.

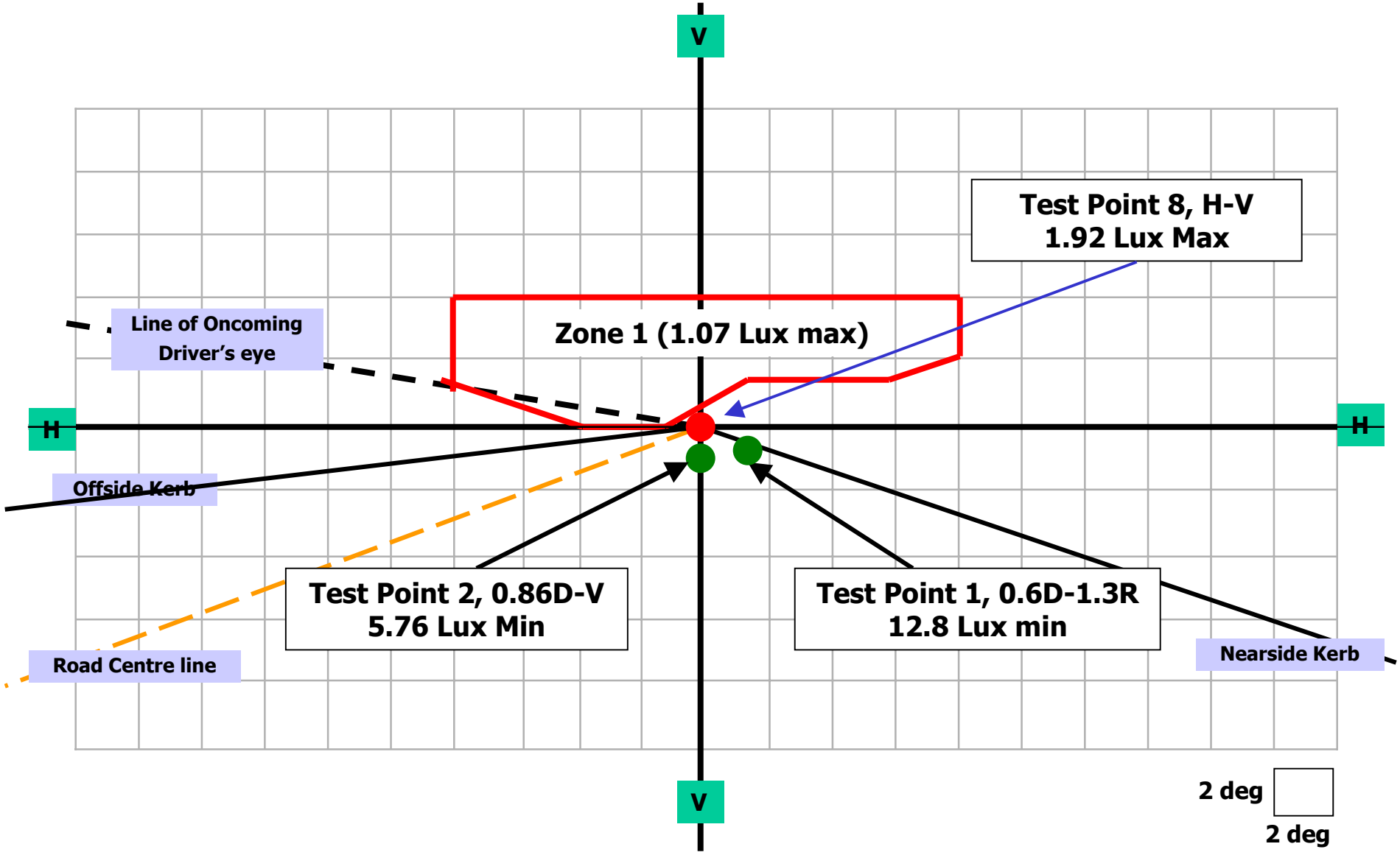
During dynamic driving situations with hills, curves, and turns the opposing driver's eye-point will move around but the length of time at H-V, if at all, will be rather small.

In passing situations on two lane roads, at short distances 50-100 m, the opposing driver's eye-point is only very rarely at H-V.

There are two test points (having a **minimum** requirement) and one zone (having a **maximum** requirement) near H-V which will significantly control the illumination at H-V.

Test Point 1, 0.6D-1.3R	12.8 Lux min
Test Point 2, 0.86D-V	5.76 Lux Min
Zone 1	1.07 Lux max

Road Diagram For RH Traffic



GTB Coordinating Committee

For a complete explanation of the specification refer to:
TRANS/WP.29/GRE/1999/18 - 22 July 1999
" RATIONALE OF HARMONIZED PASSING (DIPPED) BEAM PATTERN"

Proposed Specification
Right Hand Traffic

TEST POINT	Position in B-β Grid in angular degrees		Required Illumination in Lux at 25 m ((Min / Max)	
1	0.60 D	1.3 R	12.8	-
2	0.86 D	0	5.8	-
3	0.86 D	3.5 L	2.3	15.4
4	0.50 U	1.50 L		1.08
5	0.50 D	4.0 R	6.4	-
6	2.00 D	15 L & 15 R	1.28	-
7	4.00 D	20 L & 20 R	0.38	-
8	0	0	-	1.92
9	0.50 U	2 R	0.77	3.2
Line 10	4.00 D	4 L to 4 R	-	< 30% of Max. Intensity (2)
Line 11	2.00 D	9 L to 9 R	1.6	-
Line 12	7.00 U	10 L to 10 R	-	0.3; but 0.96 (1)
Line 13	10.00 U	10 L to 10 R	-	0.15; but 0.64 (1)
Line 14	10 U to 90 U	0	-	0.15; but 0.64 (1)
15*	4.00 U	8.0 L	0.1*	1.08
16*	4.00 U	0	0.1*	1.08
17*	4.00 U	8.0 R	0.1*	1.08
18*	2.00 U	4.0 L	0.2*	1.08
19*	2.00 U	0	0.2*	1.08
20*	2.00 U	4.0 R	0.2*	1.08
21*	0	8.0 L	0.1*	-
22*	0	4.0 L	0.2*	1.08
Zone 1	1U/8L-4U/8L-4U/8R-2U/8R-1.5U/6R-1.5U/1.5R-0/1L-0/4L 1U/8L		-	1.08
Zone 2	>4U to <10 U	10 L to 10 R	-	0.3; but 0.96 (1)
Zone 3	10 U to 90 U	10 L to 10 R	-	0.15; but 0.64 (1)

Please refer to next Page for notes and explanation

Notes:

"D" means under the HH line.

"U" means above the HH line.

"R" means right of the VV line.

"L" means left of the VV line.

(1) but 0.96 if within 2° cone

(2) < 30% of Max. Intensity and in any case < 12.8

*During measurement of these points, the front position lamp approved to ECE R7-if combined, grouped, or reciprocally incorporated-shall be switched on.

**0.25° tolerance allowed independently at each test point for photometry unless indicated otherwise.

Other general text:

ECE-Type Approval at reference luminous flux according to Regulation 37 or at objective luminous flux for gas-discharge light sources according to Regulation 99.

Nominal Aim For Photometry:

Vertical: 1%D (0.57°D)

Horizontal: Kink on V-V

Allowed Tolerances for Photometry:

Vertical: 0.3°D to 0.8°D

Horizontal: ±0.5° L-R

For a full explanation of the proposed test points and values and for a comparison of the proposed Passing Beam with the US FMVSS108 requirements, please refer to

TRANS/WP.29/GRE/1999/18 - 22 July 1999

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