THE IMPACT OF THE CURRENT OFFICIAL REGULATORY SYSTEM ON GLARE IN REAL ROAD TRAFFIC

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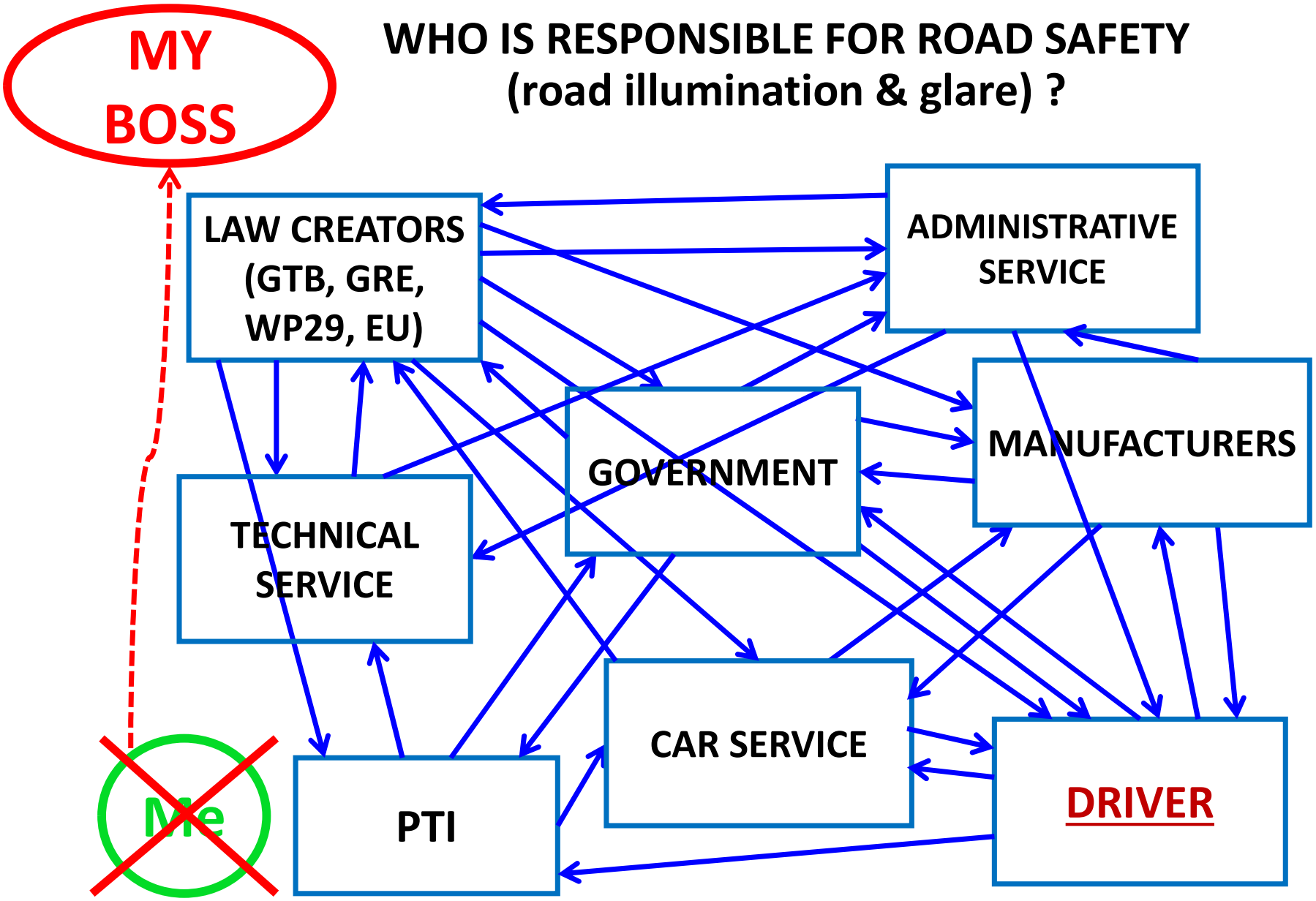
WHO IS RESPONSIBLE FOR ROAD SAFETY (road illumination & glare) ?



DRIVER

- **DRIVER BELIEVES THAT IF HE HAS PASSED THE PTI TEST, EVERYTHING IS FINE WITH HIS HEADLIGHTS**

- **DRIVERS KNOW THAT LIGHTING COMPONENTS SHOULD BE TYPE APPROVED, BUT THEY INSTALL RETROFITS BECAUSE THEY BELIEVE THAT THEIR LIGHTS ARE INSUFFICIENT**

- **THE HEADLIGHTS IN MOST CARS ARE NOT WORKING PROPERLY; THEY EITHER GLARE OTHERS OR ILLUMINATE THE ROAD TOO CLOSE**

TYPE APPROVAL SYSTEM RESPONSIBILITY

- **PRESENTLY USED SYSTEM OF TYPE APPROVAL REGULATIONS UNDER UN ECE 1958 AGREEMENT TRANSFER THE RESPONSIBILITY FOR SAFETY FROM THE MANUFACTURER TO THE APPROVAL AUTHORITY**

- **TYPE APPROVAL REQUIREMENTS DO NOT GUARANTEE THE MINIMUM SAFETY**

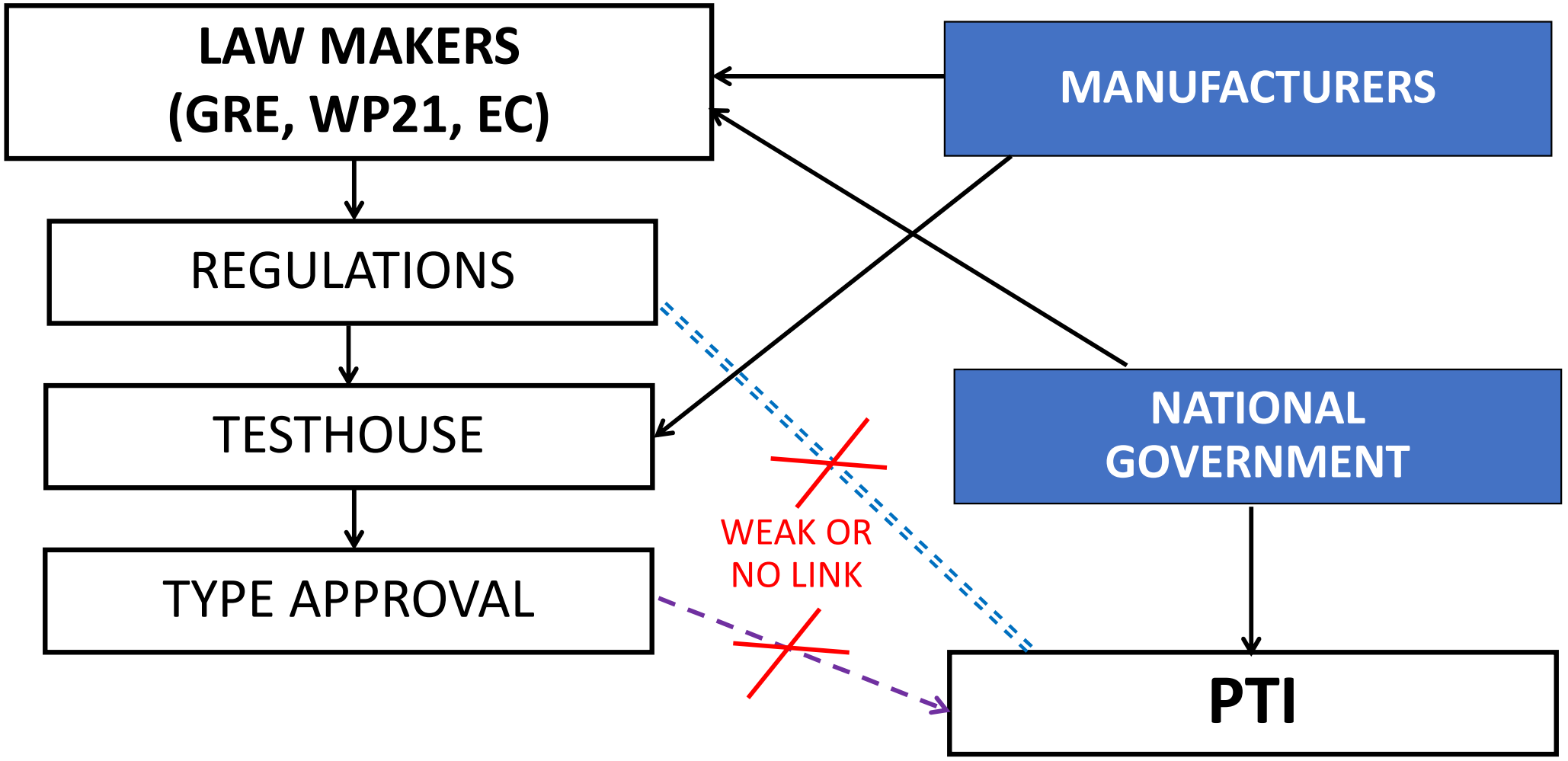
- **REQUIREMENTS ARE DESIGN BASED**

- **GLARE FACTORS ARE NOT PROPERLY REGULATED (E.G. LEVELLING TOLERANCES, LUMINANCE OF LAMP SURFACE)**

TYPE APPROVAL IN RELATION TO REAL VEHICLE

- MANUFACTURER IS OBLIGED TO PASS TESTS ON ONE OR A FEW SAMPLES AND OBTAIN TYPE APPROVAL
- MASS PRODUCTION TOLERANCES INFLUENCE FOR FINAL PERFORMANCE
- DURING VEHICLE EXPLOITATION COMPONENTS ARE SUBJECT TO AGING OR REPLACEMENT
- IN-USE REQUIREMENTS (SERVICE, PTI, ROADSIDE CONTROL) DO NOT RELATE TO ESSENTIAL TYPE APPROVAL REQUIREMENTS

RELATIONS BETWEEN TYPE APPROVAL AND PTI



SPECIFICS OF TYPE APPROVAL SYSTEM

DECISIONS ARE MADE ON THE BASIS OF COMPROMISE OR MAJORITY

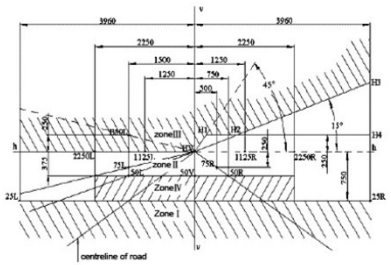
TYPE APPROVAL DO NOT GUARANTEE PERFORMANCE (SAFETY) IN REAL ROAD CONDITIONS

MANUFACTURERS ARE EXEMPTED FROM LIABILITY FROM THE MOMENT OF OBTAINING TYPE APPROVAL

IN-USE ENFORCEMENT DOES NOT VERIFY REAL PERFORMANCE (e.g. GLARE LEVEL)

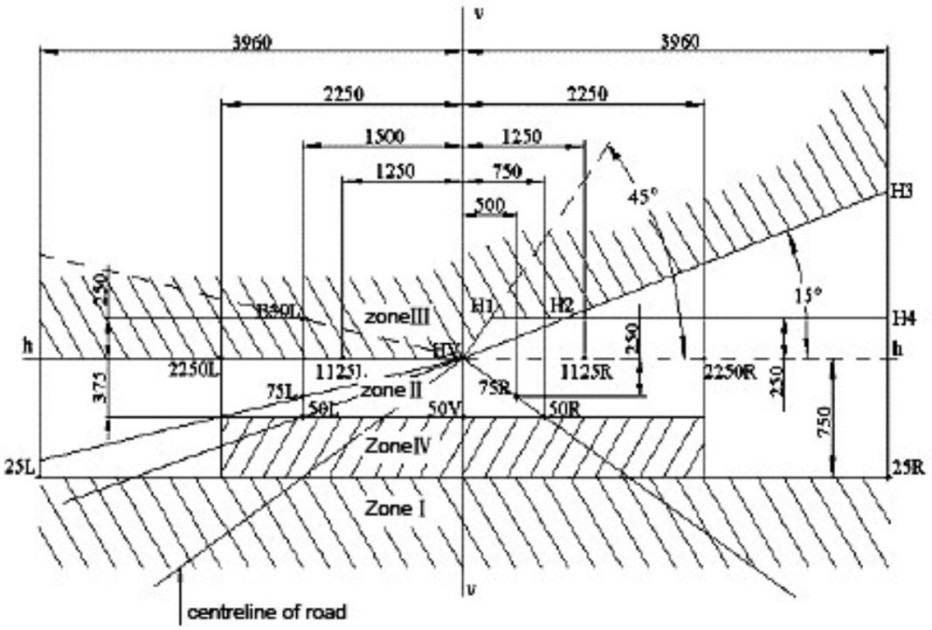
BEGINNINGS

- **SYSTEM OF TYPE APPROVAL REGULATIONS FOR HEADLAMPS IS BASED ON MATHEMATICAL MODEL OF PARABOLIC DESIGN DOUBLE FILAMENT (1958) (PASSING/DRIVING BEAM)**



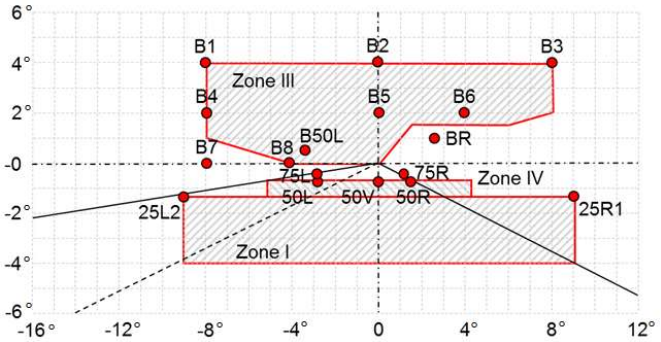
- **PTI INITIALLY BASED ON ASSUMPTION THAT IN USE CONDITION ARE THE SAME (SIMILAR TO) TYPE APPROVAL**

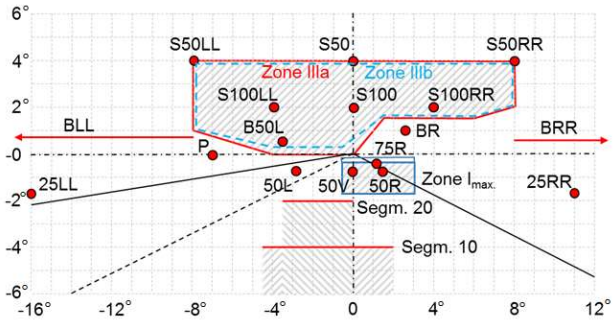
REQUIREMENTS ARE SPECIFIED FOR VERTICAL SCREEN (1958)

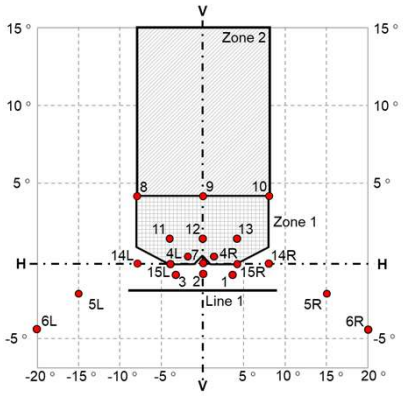


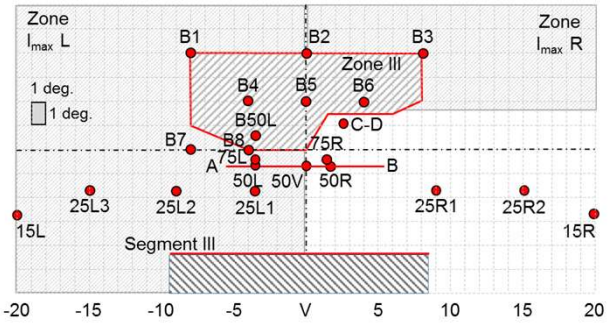
THE REGULATION DESCRIBED VALUES FOR VERTICAL SCREEN BECAUSE IS EASY TO MEASURE
BUT HEADLIGHTS ILLUMINATE THE ROAD AND GLARE EYES IN DIFFERENT PLACE BY DIFFERENT VALUE

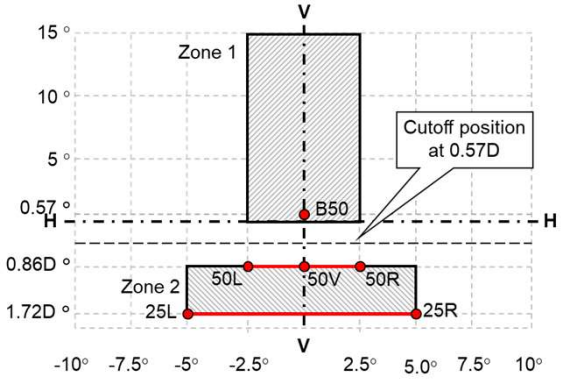
PRESENT REQUIREMENTS ARE DEFINED VERY SIMILARLY TO THE OLD





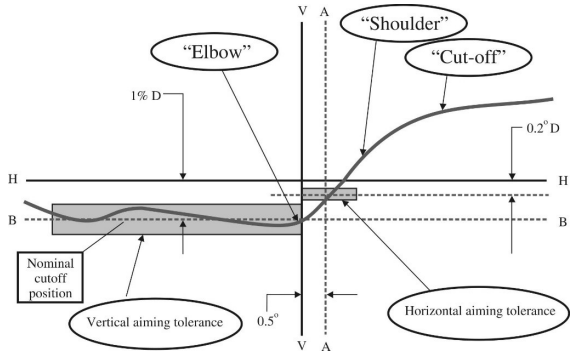


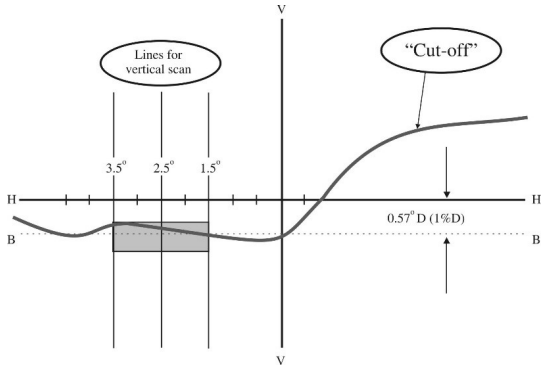




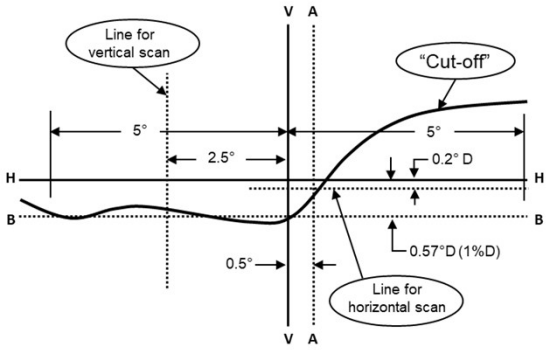
- **SCREEN (GONIOPHOTO) INSEAD OF ROAD REQUIREMENTS**
- **MANY VARIOUS REGUIREMENTS FOR THE SAME PURPOSE**
- **NOT SUFFICIENT TO PROPERLY CONTROL THE ROAD ILLUMINATION AND GLARE**

CURRENT CUT-OFF REQUIREMENTS

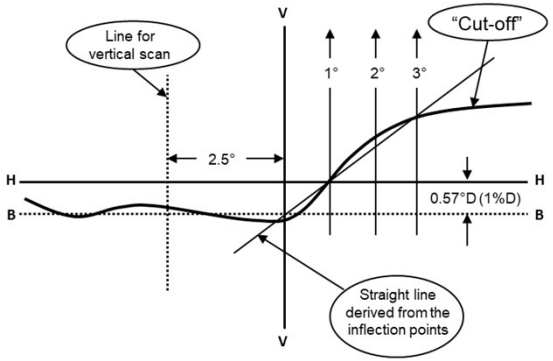




visually



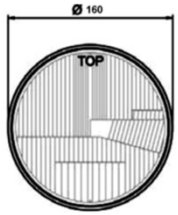
instumentally



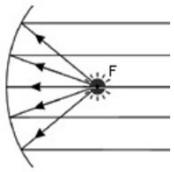
AMBIGUOUS, UNREPEATABLE

REQUIREMENTS ARE BASED ON FIXED DESIGN FACTORS

MANY SIMPLIFICATIONS WITH RESPECT TO THE PARABOLIC (OBSOLETE) CONSTRUCTION

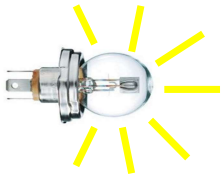


GEOMETRICAL SIZE
OF HEADLAMP

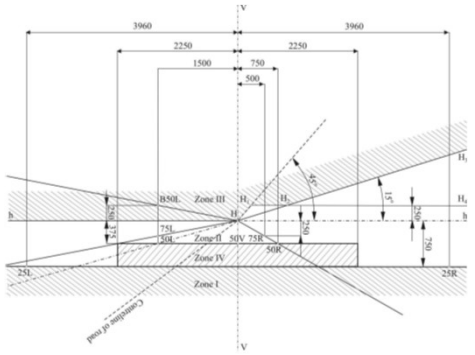


FOCAL DISTANCE OF
REFLECTOR

SHAPE AND SIZE
OF FILAMENT

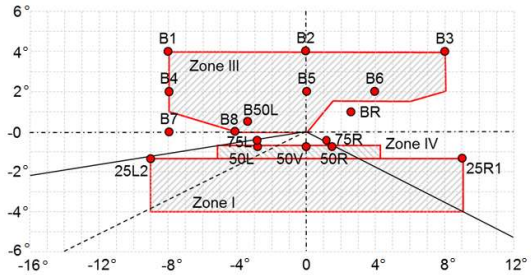


LUMINOUS FLUX
OF LIGHT SOURCE



NOT APPROPRIATE FOR OTHER TECHNOLOGIES CURRENTLY IN USE

ACTUAL LIGHTING (AND GLARE) OF CONTEMPORARY HEADLIGHTS DIFFER FROM OLD ASSUMPTIONS.



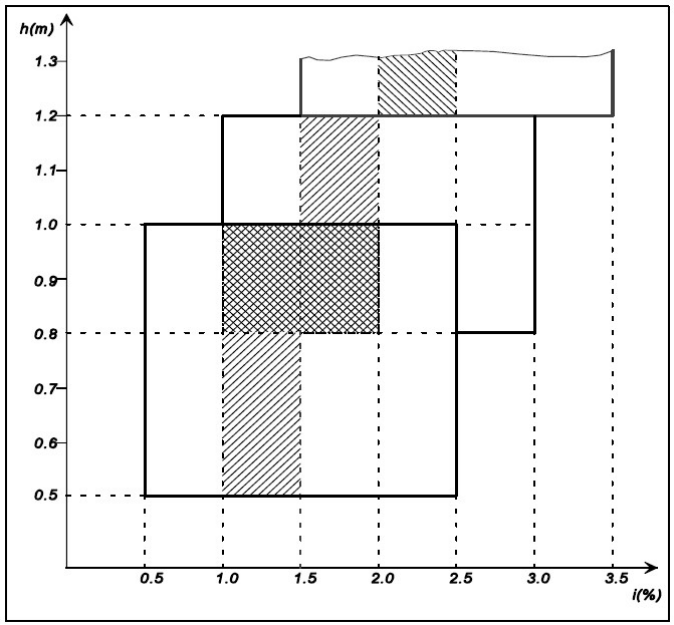
ADB REQUIREMENTS

Part A	*Test point*	*Position / Deg.* *Horizontal*	*Vertical*	*Max. intensity*** *(cd)*
	Line 1 Left Oncoming vehicle at 50 m in the case of right-hand traffic	4.8°L to 2°L	0.57°Up	625
	Line 1 Right Oncoming vehicle at 50 m in the case of left-hand traffic	2°R to 4.8°R	0.57°Up	625
	Line 2 Left Oncoming vehicle at 100 m in the case of right-hand traffic	2.4°L to 1°L	0.3°Up	1 750
	Line 2 Right Oncoming vehicle at 100 m in the case of left-hand traffic	1°R to 2.4°R	0.3°Up	1 750
	Line 3 Left Oncoming vehicle at 200 m in the case of right-hand traffic	1.2°L to 0.5°L	0.15°Up	5 450
	Line 3 Right Oncoming vehicle at 200 m in the case of left-hand traffic	0.5°R to 1.2°R	0.15°Up	5 450
	Line 4 Preceding vehicle at 50 m in the case of right-hand traffic	1.7°L to1.0°R	0.3°Up	1 850
		>1.0° R to 1.7°R		2 500
	Line 4 Preceding vehicle at 50 m in the case of left-hand traffic	1.7°R to1.0°L		1 850
		>1.0° L to 1.7°L		2 500
	Line 5 Preceding vehicle at 100 m in the case of right-hand traffic	0.9° L to 0.5°R	0.15°Up	5 300
		>0.5°R to 0.9°R		7 000
	Line 5 Preceding vehicle at 100 m in the case of left-hand traffic	0.9° R to 0.5°L		5 300
		>0.5°L to 0.9°L		7 000

„HOLES" IN REQUIREMENTS, SUBJECTIVE TESTING

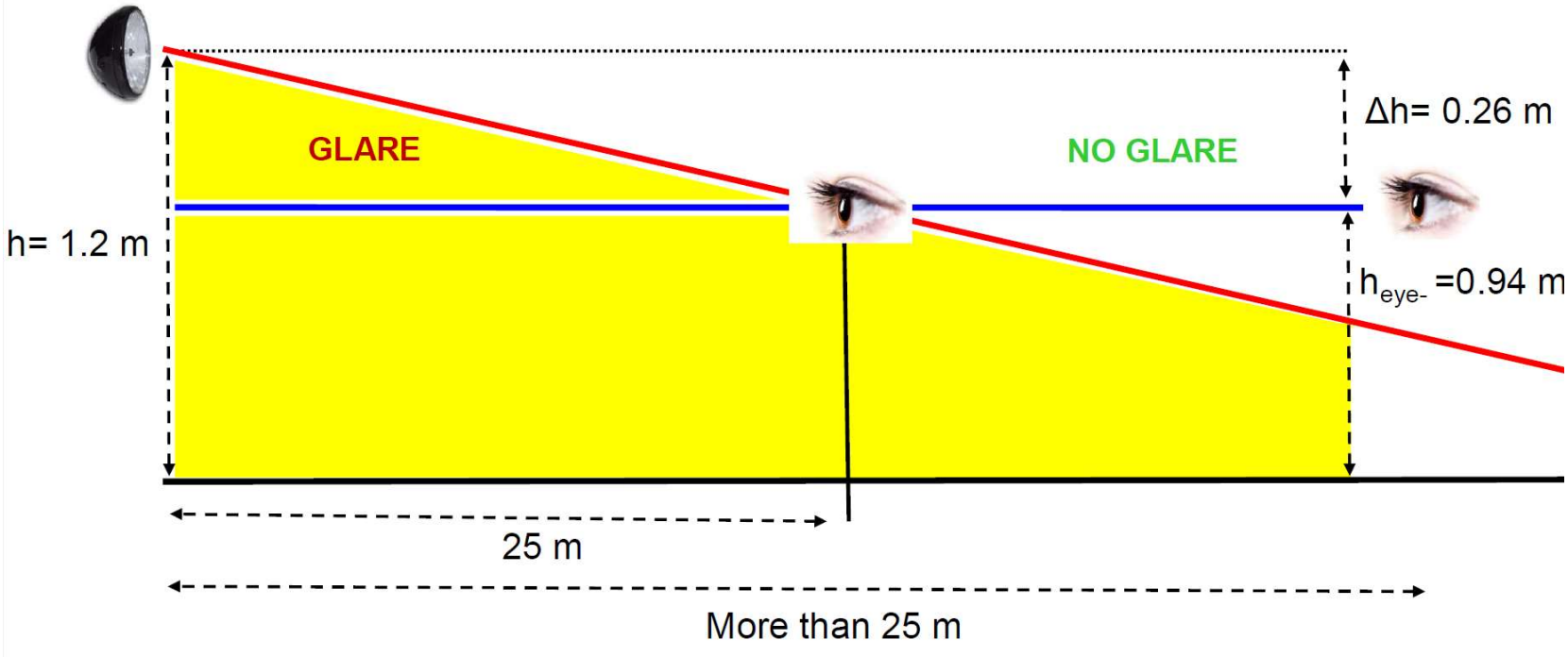
NO REQUIREMENTS FOR SENSORS AND ADAPTATION ALGORITHMS

AIMING & LEVELING PROVISION ARE INADEQUATE THE NEEDS

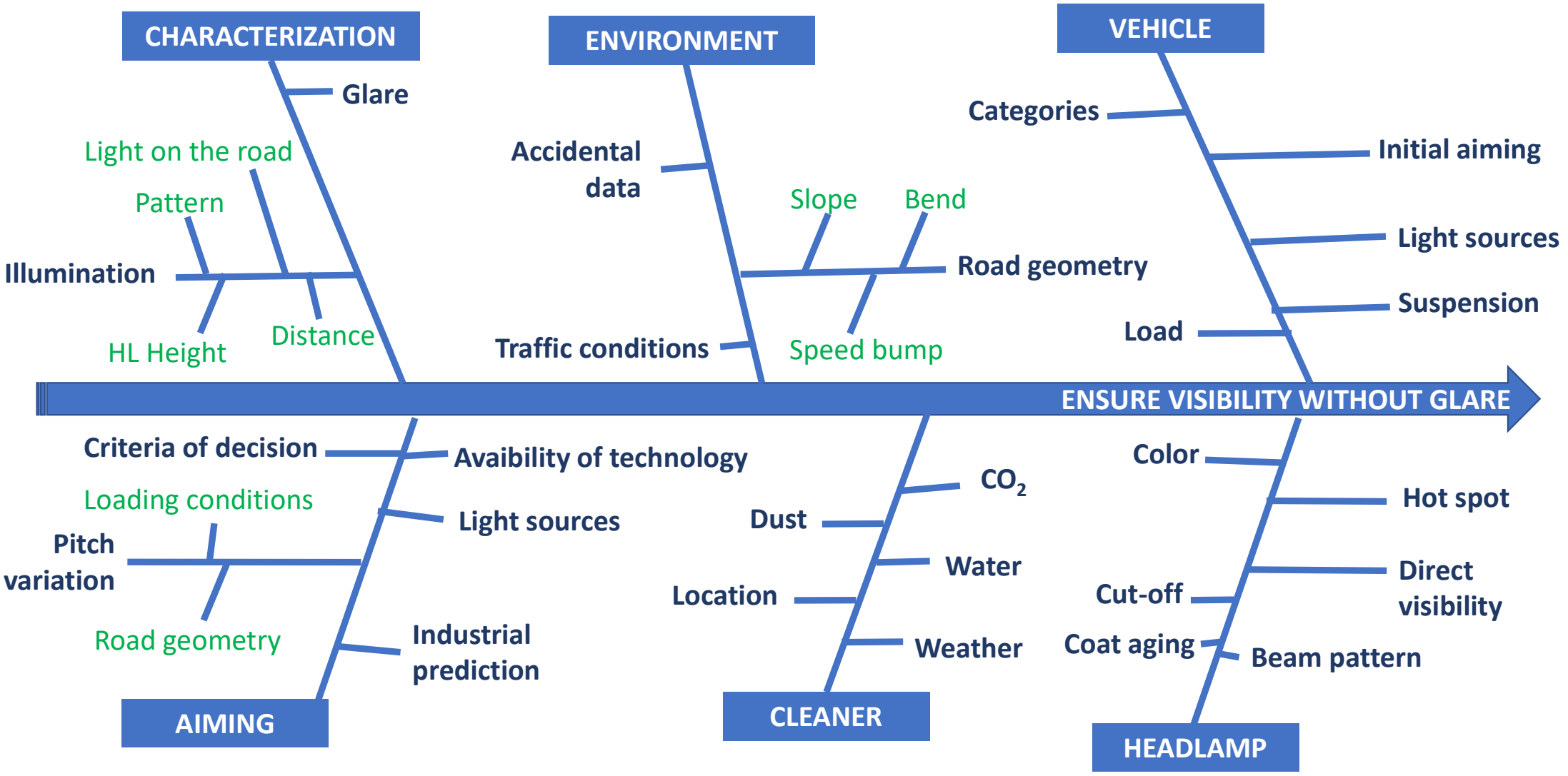


VERY LARGE RANGES OF LEVELING TOLERANCES VARYING THE ILLUMINATION RANGE FROM 20m TO 200 m.
LEGAL BUT INSUFFICIENT FOR SAFETY
DRIVERS REACT BY IMPROPER USE OF MAUAL DEVICE AND CAUSE GLARE

THE MOUNTING HEIGHT OF THE HEADLIGHTS ALLOWS FOR GLARE THAT CANNOT BE AVOIDED



SYNTHESIS OF POSSIBLE CAUSES WITH IMPACT ON VISIBILITY & GLARE (IWG-VGL)



WHAT CAUSES ARE REALLY IMPORTANT IN REAL TRAFFIC

ROAD ILUMINATION CAUSES	GLARE CAUSES	IMPACT FOR GLARE COMPLAINTS	IMPACT ON ACCIDENT RISK
1		?	[0.2%]
2		?	[70%]
3		?	…
…			
	A	[40%]	…
	B	…	[5%]
	C	…	…
	…		
	TOTAL		100%
TOTAL		100%	

IN REAL TRAFFIC GLARE IS CAUSED BY:

1. **EXCESSIVE ILLUMINANCE IN THE DRIVER'S EYES**
2. **EXCESSIVE LUMINANCE OF DISTINGUISHABLE PARTS OF THE LAMP**

AD 1. IS PARTIALLY REGULATED IN UN ECE REGULATIONS

but depend on many actual factors:

- **actual aim,**
- **actual beam pattern,**
- **light source used,**
- **light dispersion in lens,**
- **aging and dirt,**
- **road curvature,**
- **etc., etc.**

AD 2. NOT REGULATED

CONLUSION(S)

„THERE IS VERY COMPLEX MATTER”

MANY RESEARCH AND STUDY WERE DONE AND FUNDAMENTAL KNOWLEDGE IS SUFFICIENT

THE COMMON CASE IS A STRAIGHT FLAT HORIZONTAL ROAD AND APPROVAL REQUIREMENTS HAVE BEEN DEFINED FOR IT

IT IS WORTH FOCUSING ON HOW THE REQUIREMENTS FOR GLARE ARE MET IN REAL ROAD CONDITIONS FOR THIS BASIC SITUATION

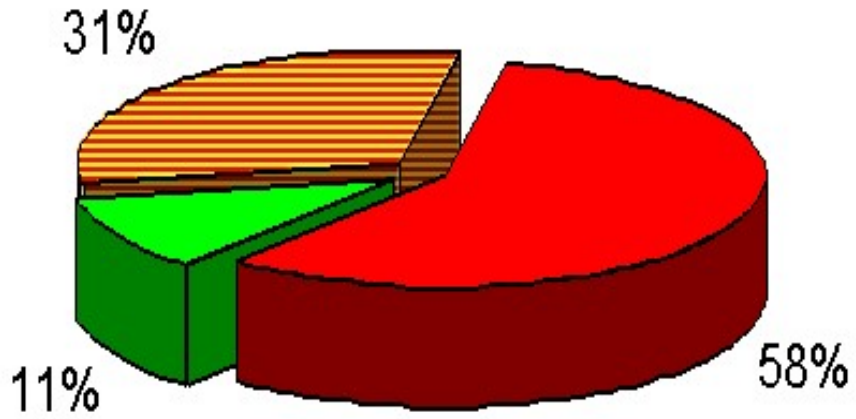
CONLUSION(S)

THREE FACTORS ARE RESPONSIBLE FOR THE PROBLEM IN ROAD CONDITIONS:

1. **THE ACTUAL AIM OF PASSING BEAM IS SET TOO HIGH**
2. **THE ILLUMINATION (INTENSITY) IN THE GLARE ZONE EXCEEDS THE ACCEPTABLE LEVEL**
3. **AUTOMATIC AND ADAPTIVE DRIVING BEAM REACT INCORRECTLY**

RESEARCH RESULTS

AIMING IN VEHICLES ON THE ROAD



AIMING IN TOLERANCE
0,5% L 2 % R
0,3 % U 0,5% D

INCORRECT AIMING
0.5% - 1%L
2 % - 4%R
0.3 % - 0.6% U
0.5 % - 1.0%D

INCORRECT AIMING (MORE)

CONLUSION(S)

Ad 1. (ACTUAL AIM TOO HIGH)

- TOO LARGE LEVELING TOLERANCES IN THE REGULATIONS (No. 48),

- PERMISSION TO USE MANUAL LEVELING DEVICE,

- NO DETAILED REQUIREMENTS FOR PERFORMANCE OF AUTOMATIC LEVELING

- IMPRECISE REQUIREMENTS REGARDING THE CUT-OFF LINE BOTH DURING TYPE APPROVAL TESTS AND DURING SERVICE/PTI ADJUSTMENTS.

CONLUSION(S)

AD 2. (HIGH ILLUMINATION IN THE GLARE ZONE)

- DIRTY AND TARNISHED LENS (ESPECIALLY PLASTIC) AND REFLECTORS,

- DIFFERENCES BETWEEN MASS-PRODUCTION BULBS AND ETALON BULBS,

- INSTALLING UNAUTHORIZED BULB REPLACEMENTS, INCLUDING LED RETROFITS.

LOCALLY PERMITTED LED RETROFITS WERE TESTED WITH BRAND NEW HEADLAMPS. BUT ARE USUALLY INSTALLED IN OLD TARNISHED LAMPS. THEY HAVE A GREATER LUMINOUS FLUX TRANSMITTED THROUGH THE LENS, WHICH INCREASES THE INTENSITY OF ILLUMINATION IN THE GLARE ZONE FOR USED HEADLAMPS

AD 3. (ADB RELATED)

- INSUFFICIENTLY PRECISE ABD REQUIREMENTS IN TYPE-APPROVAL REGULATIONS (APPLICABLE TO ALL REQUIREMENTS)

- IMPERFECTION IN ONCOMING AND PRECEEDING VEHICLE RECOGNITION SYSTEMS AND LIGHTING CONTROL SYSTEMS

- NO POSSIBILITY OF ADB TESTING BY PTI AND IN INDEPENDENT SERVICES

THANK YOU FOR YOUR ATTENTION!