Road Traffic Signs

Wolfgang Kramp

3M Traffic Safety Systems Laboratory

Sofia, Bulgaria

ERF Seminar
22 February 2012

Road Traffic Signs

Overview

1. Traffic Sign Requirements
2. Retroreflective Technology
3. Environmental Aspects
4. Driver's Needs – Effectiveness
5. Outlook – EN 12899-6

Traffic Sign Requirements

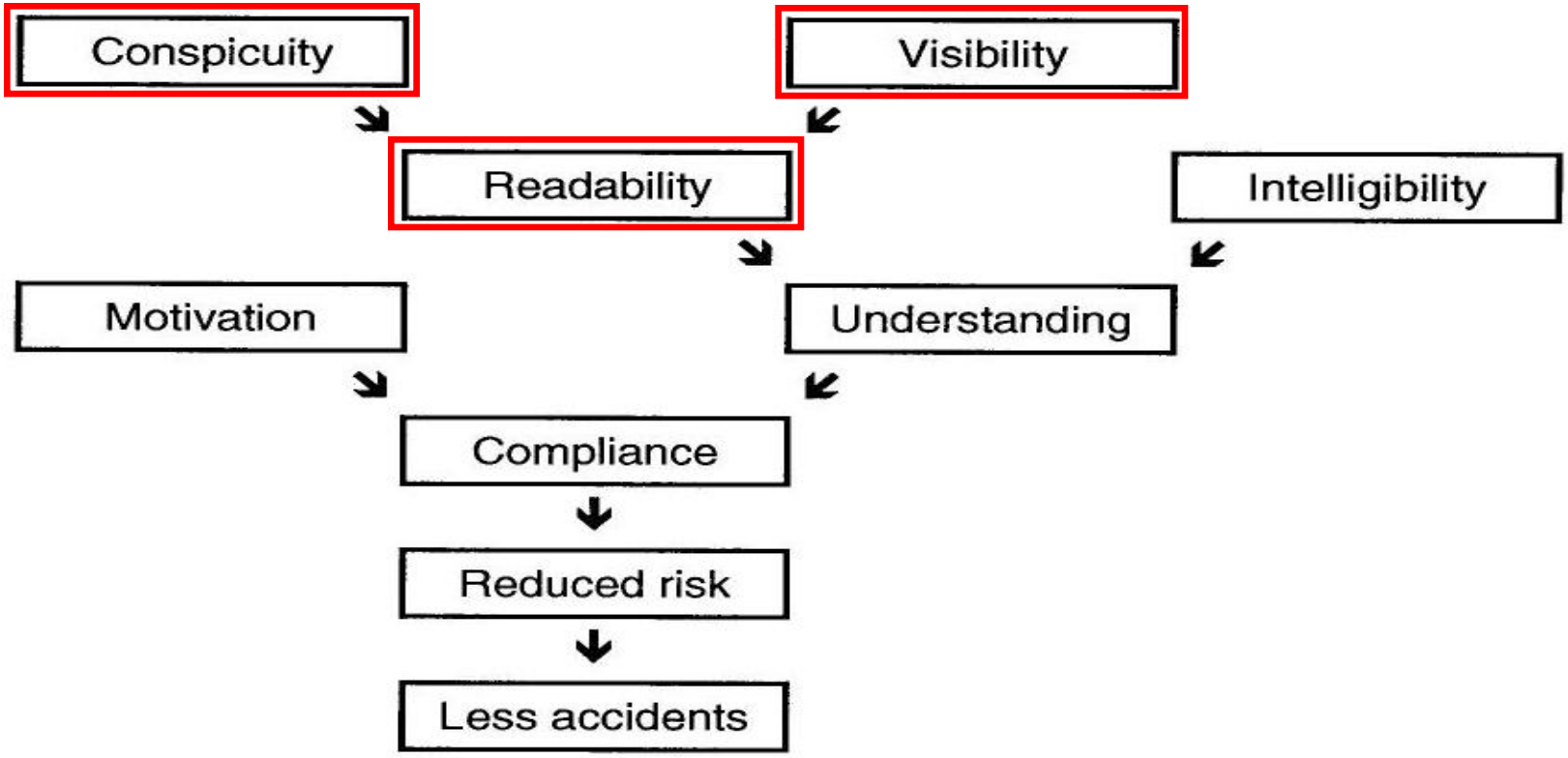


Figure 24: A general model of factors that affect the effects of traffic signs on road safety

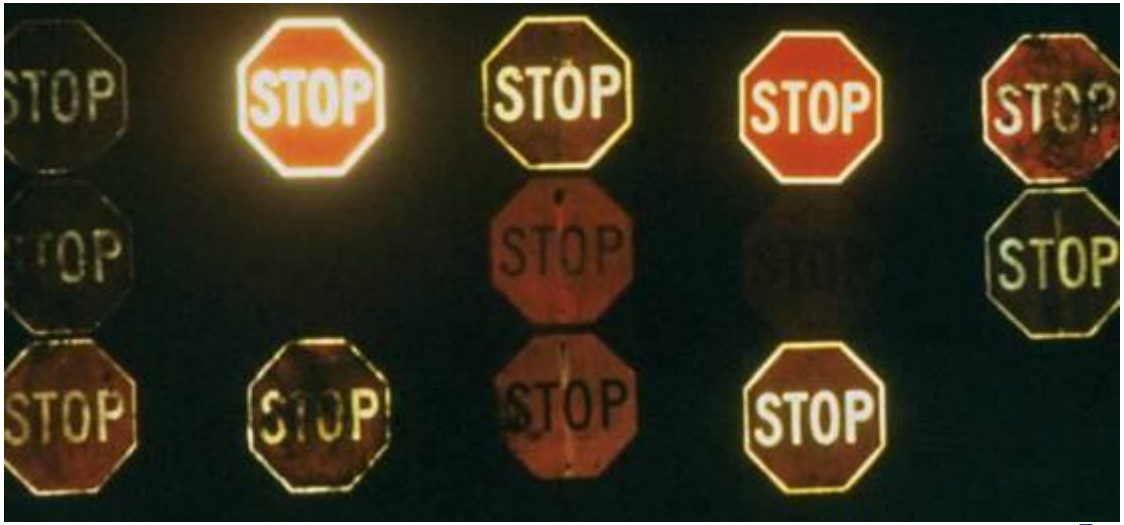
Source: *"General Overview on Road Safety," Lecture Notes, Dr. Rune Elvik, Institute of Transport Economics, Norway, Sept.1999.*

Traffic Sign Requirements

Conspicuity and Readability

What you see during the day

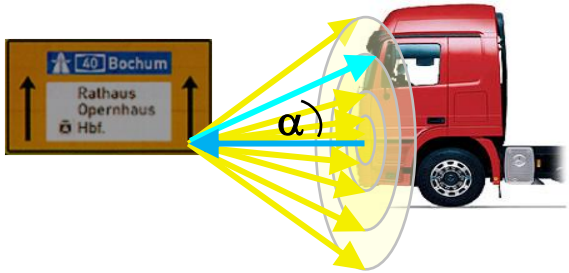
Is not always what you get at night



Conspicuity and Readability

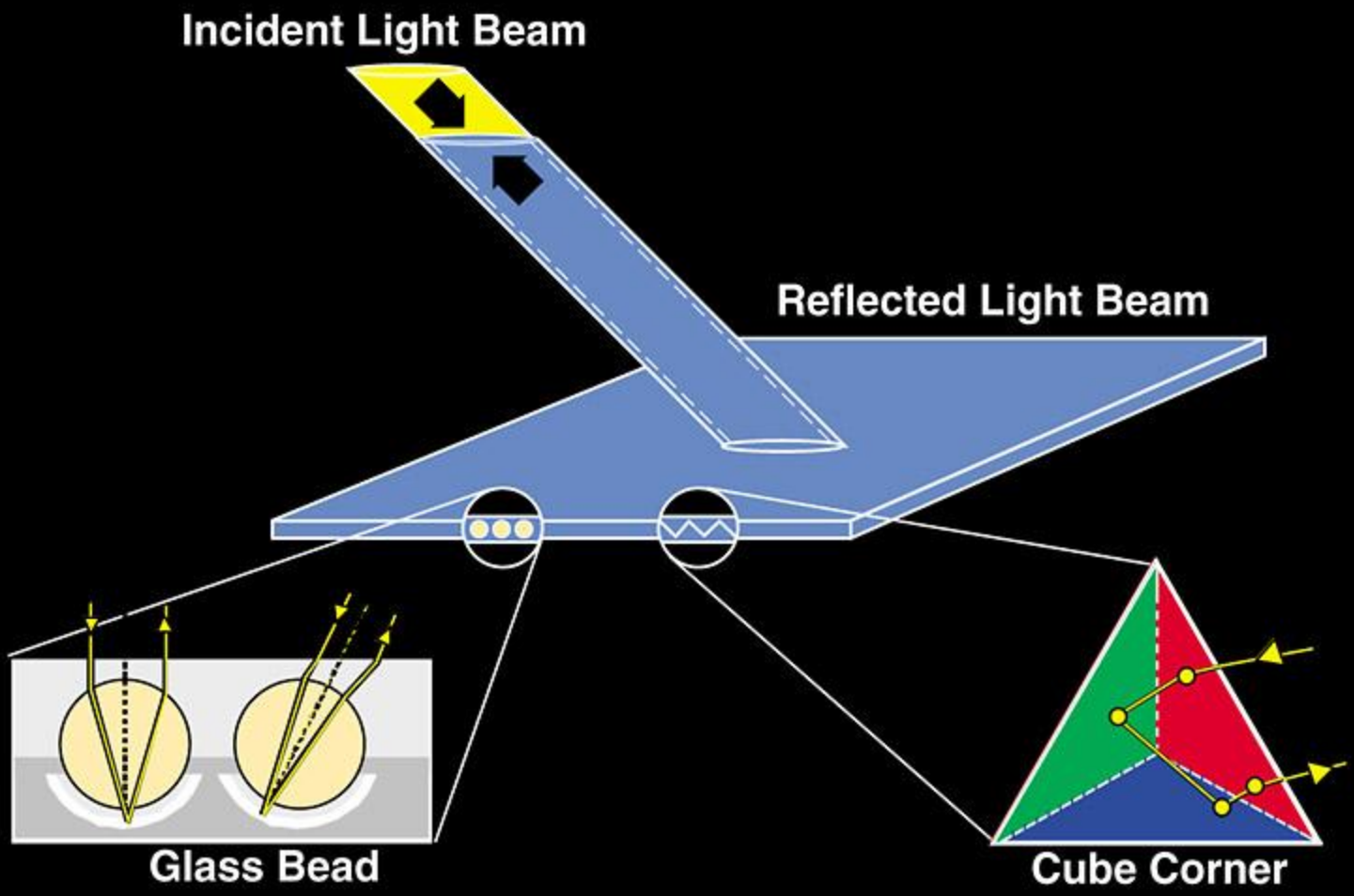
At severe weather conditions
(rain, fog, dust, dawn, …)

For disadvantaged drivers
(of trucks, vans, suvs)



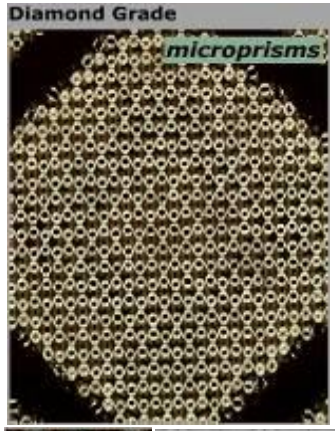
Protect vulnerable road users (kids, pedestrians, CWZ workers & drivers,..)

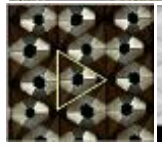
RETROREFLECTION

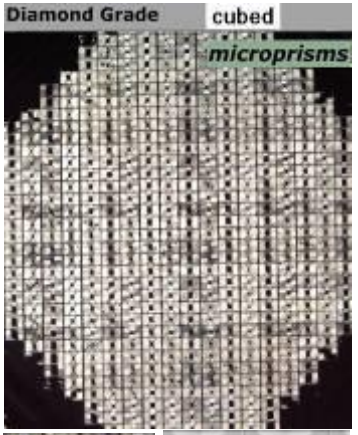


Two Systems of Retroreflection

Retroreflective Sign Sheeting History







1939 : Birth of the first Scotchlite product

1948 : Development of Engineer Grade sheeting

1949 : Introduction of retroreflective fabrics

1965 : Introduction of Scotchlane marking tapes

1971 : Introduction of High Intensity Sheeting

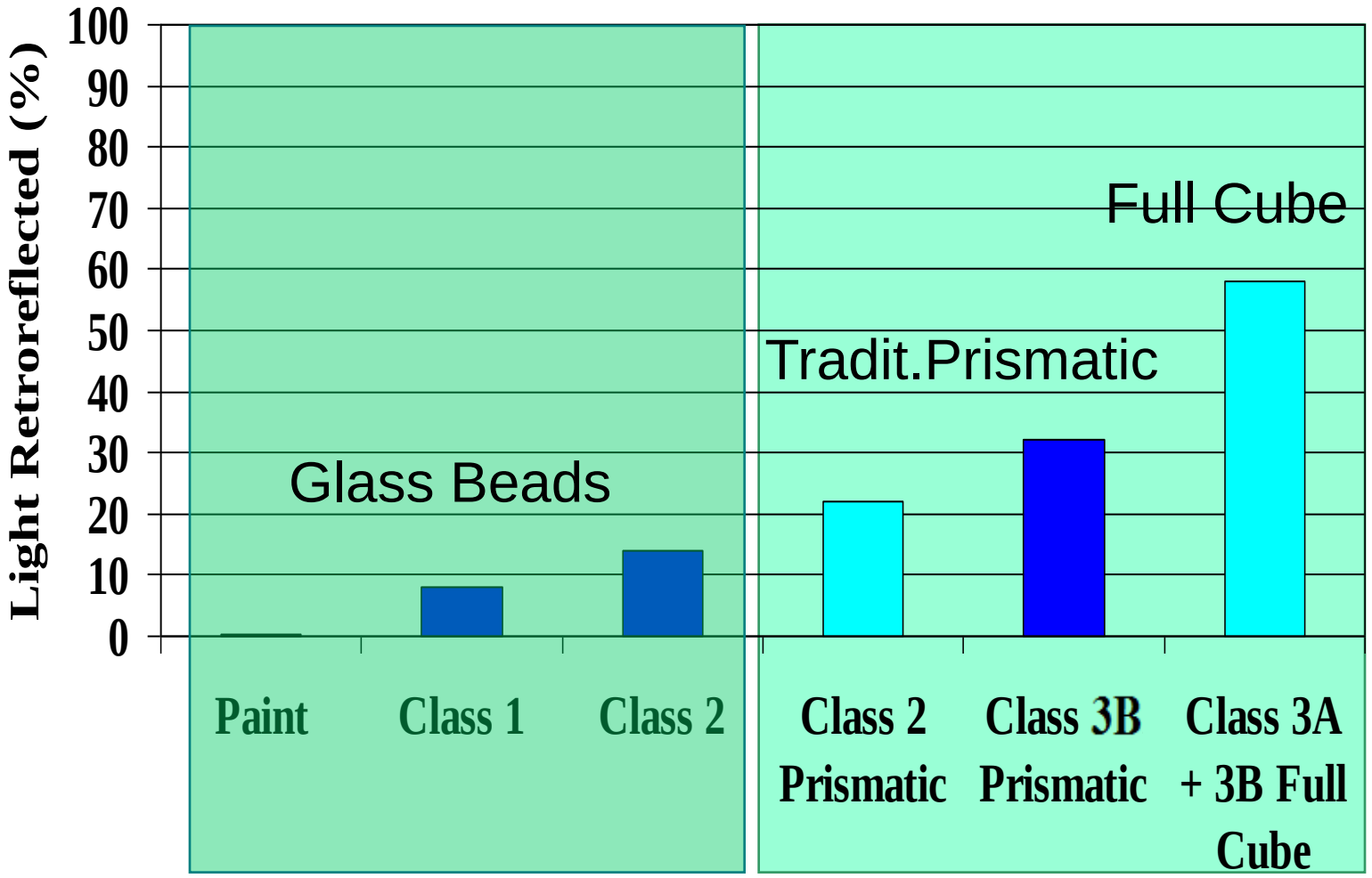
1976 : Introduction of Stamark marking tapes

1988 : Introduction of Diamond Grade sheeting

2005: Introduction of Diamond Grade Cubed sheeting

1940 1950 1960 1970 1980 1990 2000

Retroreflective Technology
Light Return Efficiency



Retroreflective Technology

Material Definition

- EN 12899-1 defines Class RA1 and RA2 (EG and HI) => CE
- ETA (Microprismatic) acc. to EU Regulation No.305/2011 => CE
  (replacing Council Directive 89/106/EEC, “CPD”)
- National (e.g. DIN, UNI, UNE)

Positioning matrix

- national responsibility
- according to sign type
- according to surround
- according to road type

Performance Classes

prEN 12899-6 'Visual Performance'

- Guideline for the Selection of Performance Classes

  ≈ Class 1 'Inadequate Performance…'

  ≈ Class 3 'Much better performance, but still reduced compared to daylight'

Germany ‘positioning table’

		environmental conditions					
		normal illuminated areas			bright areas and/or lots of external light sources		
Sign	**position**	**motor-way**	**rural**	**urban**	**motor-way**	**rural**	**urban**
all signs	right	2	1/2	1/2	2/3	2	2/3/B
beside the following	overhead/ left	2	2	2	3	2/3	3/B
Warning ans stop signs: on railway crossings			2	2		3	3
on intersections and junktions		2	2	2	3	3	3/B
signs giving directional orders		2	2	2	3	3	3/B
construction work zones		2	1/2	1/2	2	2	2
Busstops, parking, touristic signs		1	1	1	1	1	1

‘Use Table’ Spain

TABLE 701.3
CRITERIA FOR SELECTING THE MINIMUM LEVEL OF RETROREFLECTION

TYPE OF SIGN OR NOTICE	LOCATION OF SIGN OR NOTICE		
	URBAN FRINGE AREA (side streets, ring roads)	MOTORWAY, DUAL CARRIAGEWAY AND FAST LANE	CONVENTIONAL ROAD
POLICE SIGNS	Level 2 (**)	Level 2	Level 1 (*)
GUIDE SIGNS	Level 3	Level 3	Level 2 (**)

(*) “Level 2” must be used for signs indicating danger warnings, priority and no entry.
(**) The suitability of “Level 3” must be studied whenever the surrounding lighting hinders visibility where it is thought necessary to increase road signs and in areas where large traffic flows converge or diverge, intersections, junctions etc.

3. Environmental Aspects

(Prismatic Reflective Sheeting Production compared to Glass Bead ‚Class 2')

Saving in VOC emission

- 97%

Reduction of Solid Waste

- 46%

Saving in Energy Consumption

- 77%

Traffic Signs & Traffic Safety

Is it effective ?

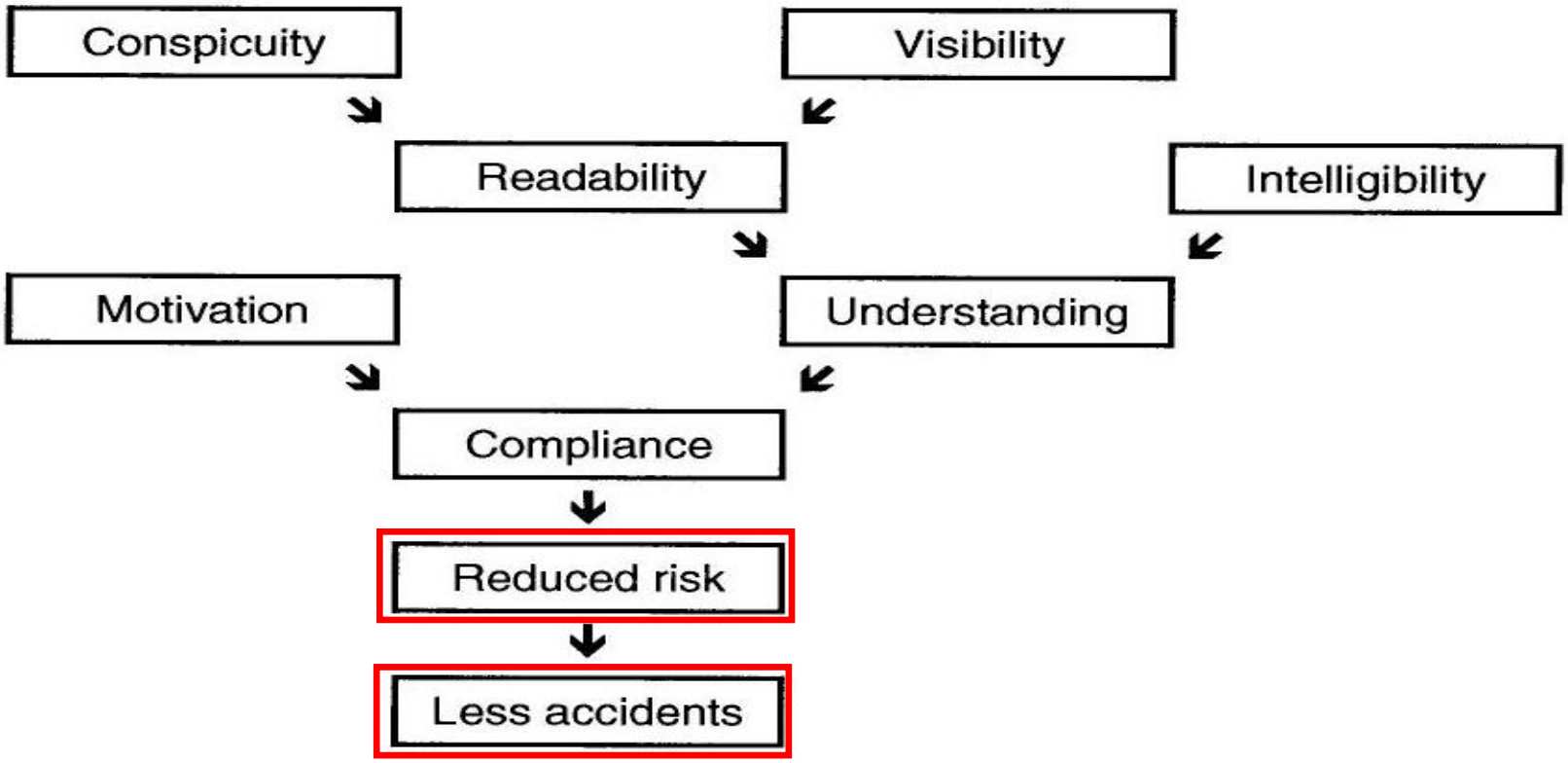


Figure 24: A general model of factors that affect the effects of traffic signs on road safety

4. Driver's Needs - Effectiveness

Review of latest research

1. Subjective Rating
2. % drivers served

On-Road Test
‘Traffic Sign Performance’

Glass Bead vs. Microprismatic Technology

Kuratorium für Verkehrsicherheit KfV, Vienna, 2005

Authors:

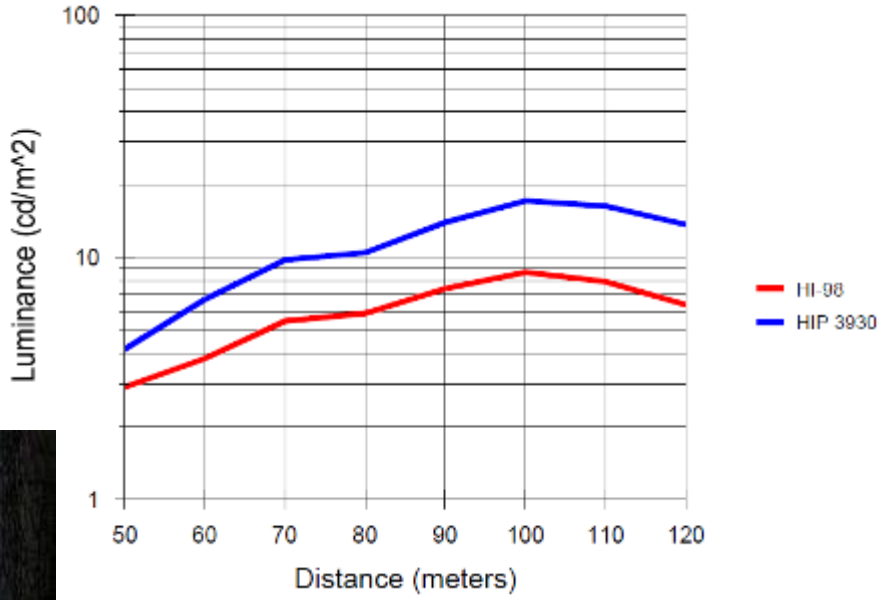
Dr. Michael Gatscha

Sandra Reichenauer

On-Road Test

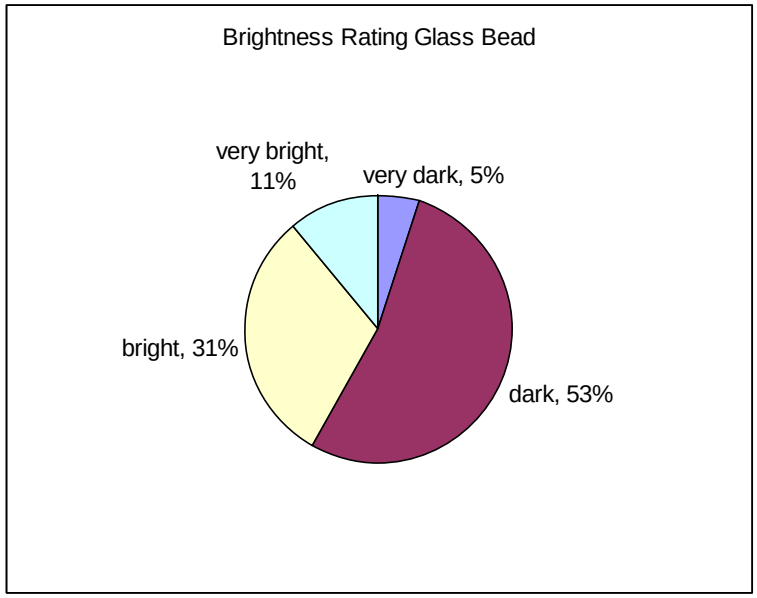
Glass Bead vs. Prismatic

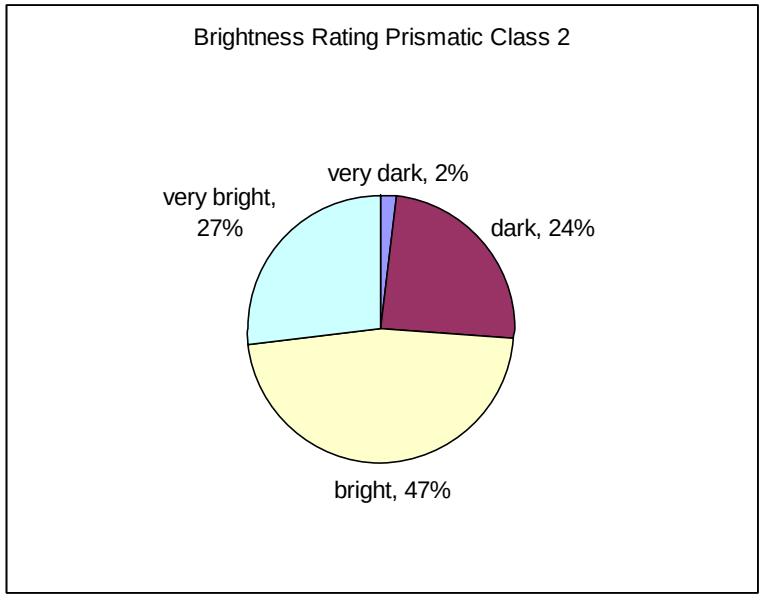
Class RA 2 according EN 12899-1



On-Road Test

subjective brightness rating





- Prismatic Class 2 Technology is ‘bright enough’ for 74%
- Glass Bead only ‘bright’ for 42%

Perceived brightness often correlates with age

20 Years 33 Years 46 Years 59 Years

Driver Age

‘Percent Drivers Served’

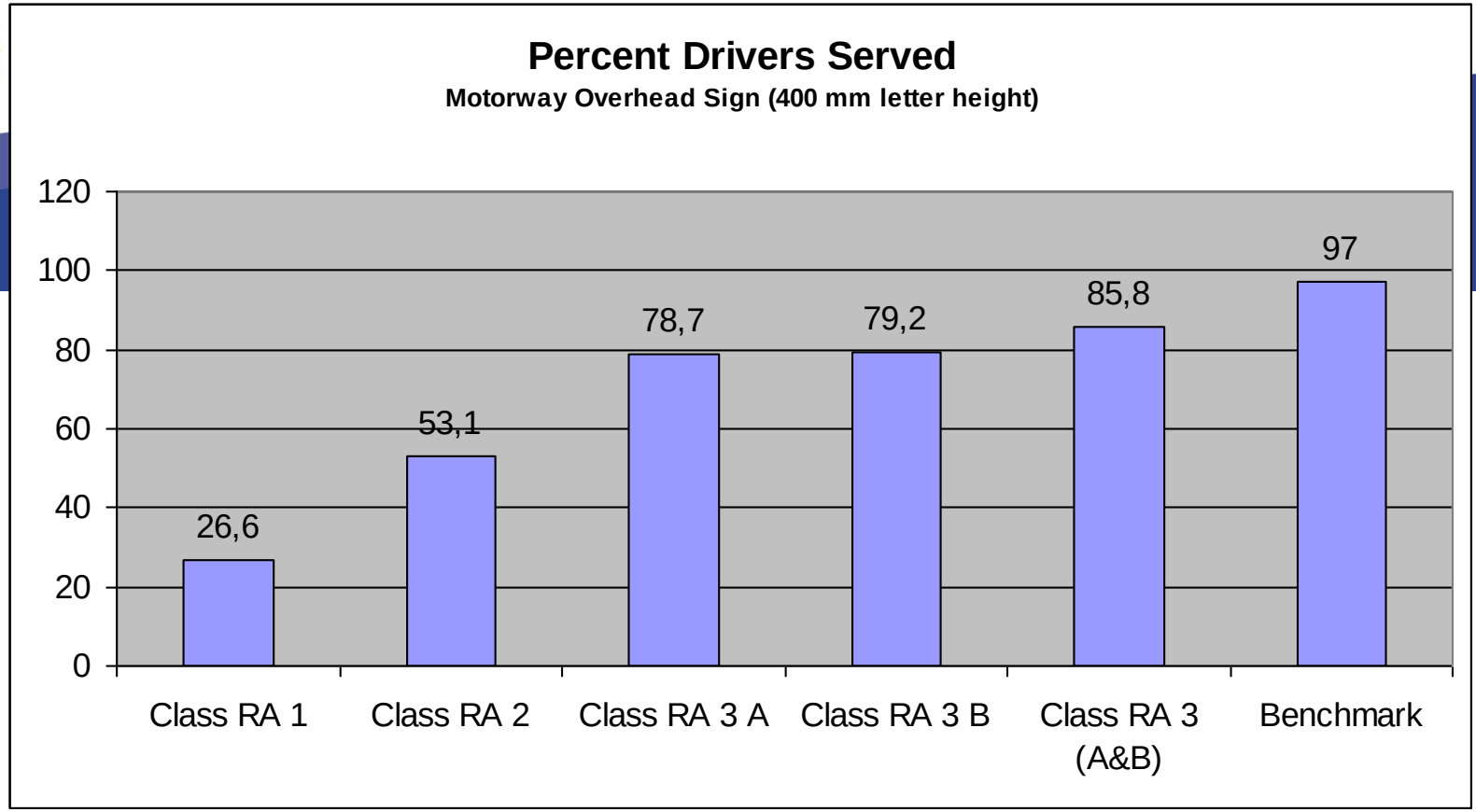
for Headlight Illuminated Retroreflective Overhead Signs

ISAL Symposium, Technical University Darmstadt, 2005

Authors:

Norbert L. Johnson

Gernot Sauter

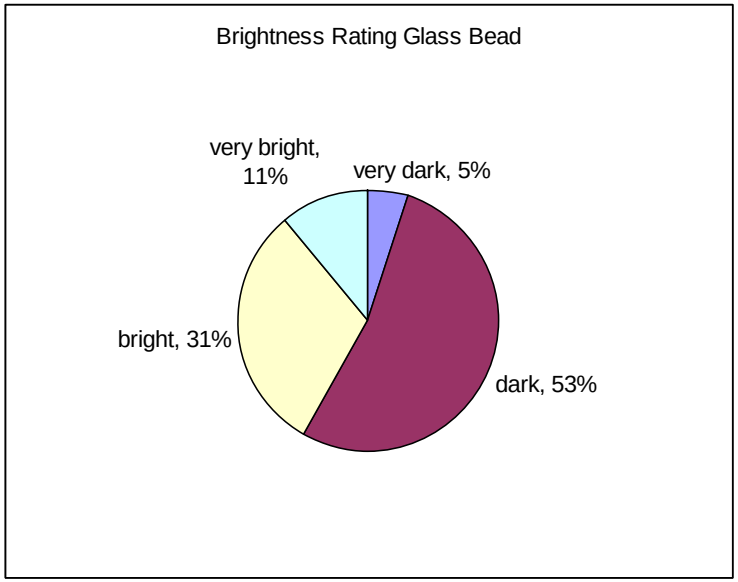


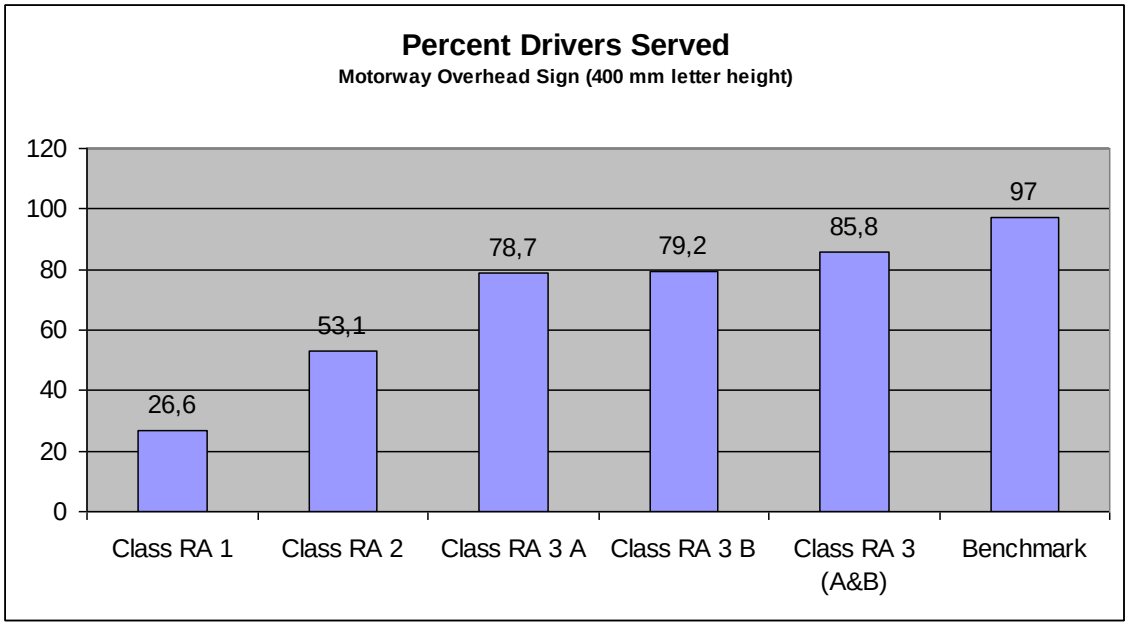
- Calculated 'Percent Drivers Served' level for an overhead sign with large letters (representative of motorways).

- Glass bead technology (Class RA 1 and RA 2) can only satisfy the performance expectations of a small percentage of drivers

- Microprismatic materials give much better service levels, closer to the benchmark performance.

Summary
Drivers Needs Studies





- Glass Bead Class 2 satisfies only ≈ 50% of drivers
- Microprismatic Class 3 can serve ≈ 85% of drivers

5. Outlook – EN 12899-6

CEN/TC 226 WG 3 N 0097

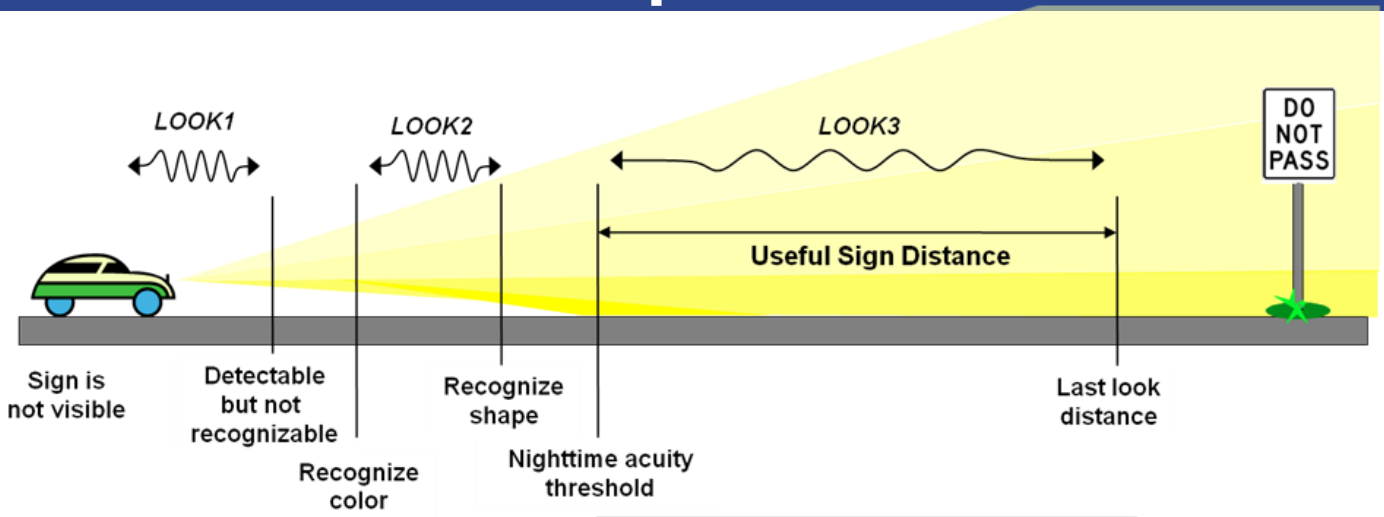
Fixed vertical road traffic signs — Part 6: Performance of retroreflective sign face materials

Build Two Universal Classes based on ‚Drivers Needs‘

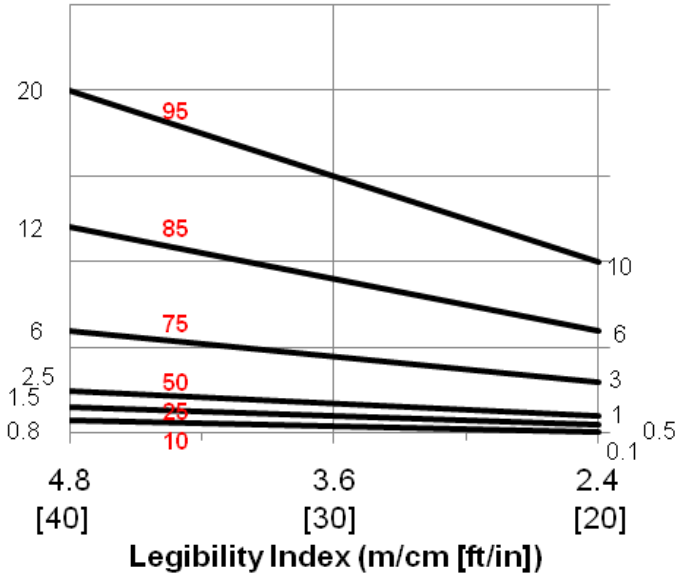
- Performance selection based on latest scientific research on luminance demand
- Classes of universal use for long/medium and short distance up to high angularity
- Clear performance differentiation between 2 Classes

Outlook – EN 12899-6

Example for selection of performance classes



- Assume 85%tile of drivers
- ‚First Look' 12 cd/m² ≈ P7
- ‚Last Look' 6 cd/m² ≈ P5
- Low/medium & high complexity



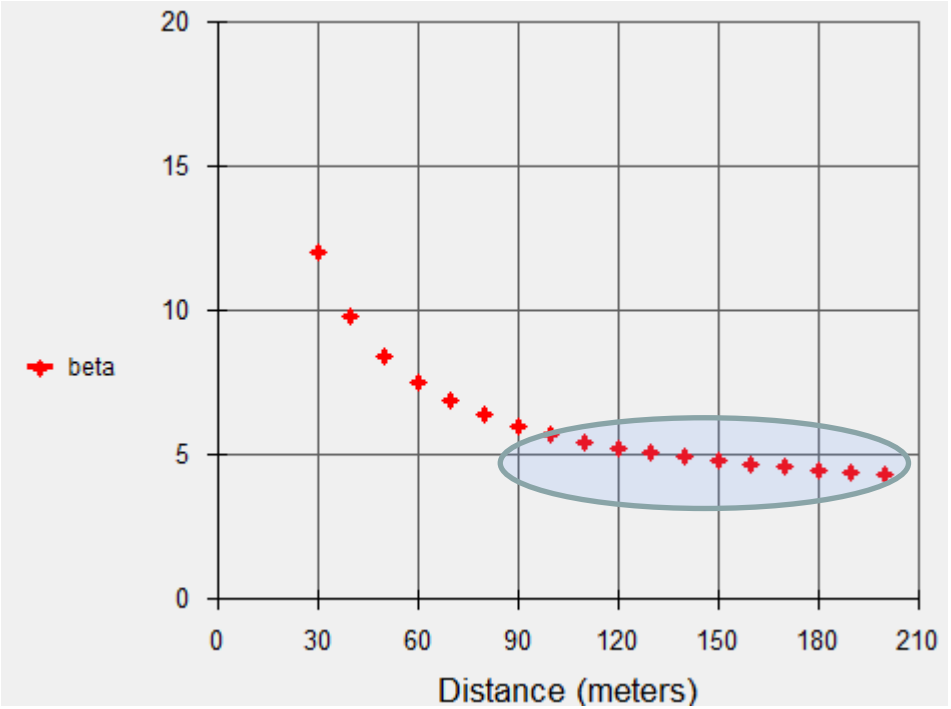
Carlson, P.J. and Hawkins, H.G. (2003) *Updated Minimum Retroreflectivity Levels for Traffic Signs.* Report FHWA-RD-03-081. FHWA, U.S. Dept. of Transportation.

Outlook – EN 12899-6
Example for selection of performance classes

‚First Look‘ Application Class A11

- 200 m Long Distance
- 5 Entrance Angle

RS – Right Shoulder Sign (5 m offset)



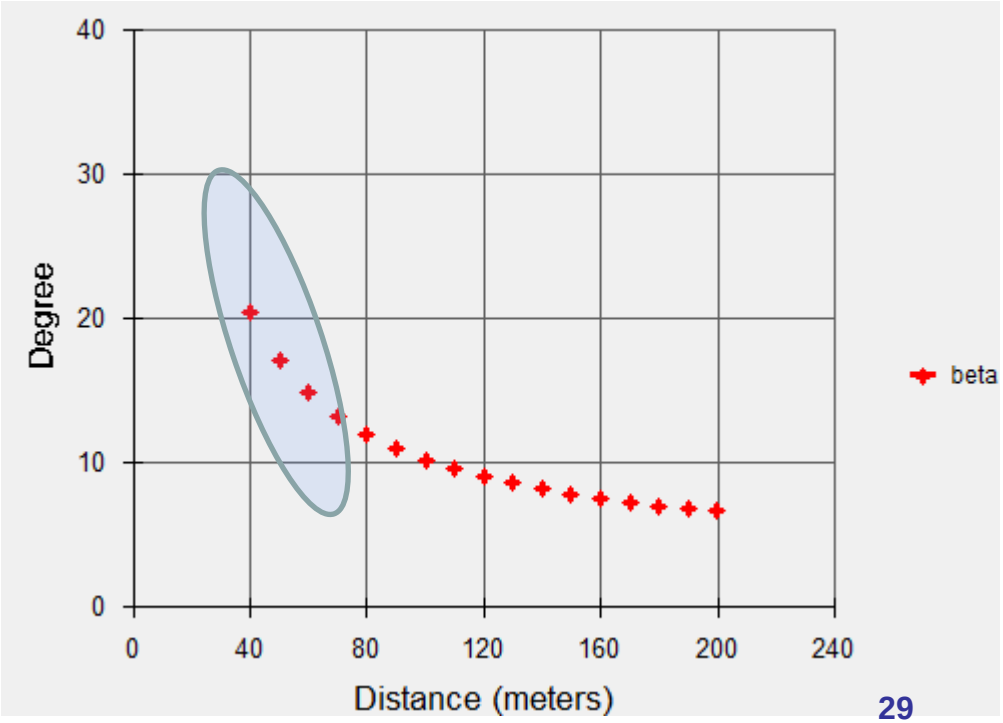
Outlook – EN 12899-6

Example for selection of performance classes

‚Last Look‘ Application Class A23

- 40 m Medium Distance
- ≤ 30 Entrance Angle

FR – Far Right Shoulder Sign (12 m offset)



Outlook – EN 12899-6
Example for selection of performance classes

	Performance Class
Application Class	**R2 High**
A11	P7
A23	P5
A34	P2

High Performance Class ‚R2‘

- Serves 85%tile of drivers
- P7 = 11.3 cd/m² Long Distance ‚First Look‘
- P5 = 5.6 cd/m² Medium Distance ‚Last Look‘
- P2 = 2 cd/m² Safeguard Performance for short distance / disadvantaged signs at 40

Outlook – EN 12899-6
Example for selection of performance classes

	Performance Class	
Application Class	**R1 Low**	**R2 High**
A11	P4	P7
A23	P2	P5
A34	P1	P2

Low Performance Class ‚R1'

- ½ logarithmic step (≈1/3) lower than High Performance Class >> visible difference on the road
- Safeguard Performance for disadvantaged signs at 40
- Clear performance differentiation between Class R1 and R2

Summary

- Scientific Selection of Performance Classes based on ‚Drivers Needs‘
- 2 Performance Classes of universal use with clear differentiation

	Performance Class	
Application Class	**R1 Low**	**R2 High**
A11	P4	P7
A23	P2	P5
A34	P1	P2

Informative R_A reference values

R2 High

Observation Angle α	Entrance Angle β			
	5°	15°	30°	40°
0,20°	750			
0,33°	372	179	160	
0,50°	208	99	90	28
0,70°	130	62	56	18
1,00°	79	38	34	11
1,50°	22	21	19	6
2,00°	5.3	5.1	4.6	4

R1 Low

Observation Angle α	Entrance Angle β			
	5°	15°	30°	40°
0,20°	266			
0,33°	132	64	57	
0,50°	74	35	32	20
0,70°	46	22	20	12
1,00°	28	14	12	7.6
1,50°	8	7.6	6.8	4.2
2,00°	3.7	3.6	3.2	2.8

Questions?


3M
Traffic Safety Systems Division
Thank You
YOUR SPEED
25
IMPULSE