The RMT version 3.0

Purpose and status 2018

Christian Nilsson

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WHY ROAD MARKINGS?
PERFORMANCE BY FUNCTIONAL AND GEOMETRICAL ASPECTS

COST 331 (1999)
REQUIREMENTS FOR HORIZONTAL ROAD MARKINGS

$$VL = \Delta L \times \alpha^2/(A + B \times \alpha)^2 \qquad \textit{(Equation 1)}$$

where

α	is the target size in minutes of arc.
ΔL	is the luminance difference in (cd/m^2).
A and B	are functions of the background luminance (L_b) in (cd/m^2).
VL	is the visibility level.

EN 1436

- Retroreflection night dry/wet
- Daytime luminance
- Skid resistance
- *Geometry (length, width, gap)*
- *Coverage (wear)*

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WHY ROAD MARKINGS?
RIGHT DOWN TO USERS

Visual guidance– see what's ahead of you

Preview time – see what's ahead of you, **in time**

Traffic safety – stay in your lane

Law enforcement – reinforcements of traffic regulations

New technology! Because car support systems now use road markings as a key attribute in visual guidance

Human demands = vehicle demands?

CW

ACC

DA

LDW

LCA

DAC

BLIS

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WHY ROAD MARKINGS?
RIGHT DOWN TO USERS

Simon Sternlund (2016) : *The effect of LDW*

LDW stands for a 50 % reduction of meeting and single accidents on roads 70-120 km/h without snow and ice.

The *effect* corresponds to

- ***30 killed***
- ***258 severely injured***
- ***1420 mildly injured***
- ***1260 accidents involving personal injury***

→ We can now see societal benefits on road marking performance!

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WHY ROAD MARKINGS?
RIGHT DOWN TO USERS

Joint statement on Road Infrastructure Safety Management Directive 2008/96

The focus is there!

But tools to monitor?

Joint Statement on Revision of the Road Infrastructure Safety Management Directive 2008/96

4. **Roads that Cars can Read: Road Markings and Road Signs**

We support the EC proposal to:

- Develop EU general performance requirements on road markings and road signs in maintenance budgets to achieve optimal performance of Advanced Driver Assistance Systems (ADAS), such as Lane Departure Warning and Traffic Sign Recognition.

We furthermore call for:

- Setting minimum performance standards for road markings and road signs to facilitate recognition both by human drivers and connected and autonomous vehicles.

In-vehicle safety technologies which rely on road markings and traffic signs are increasingly common. Semi-automated or fully-automated vehicles will rely on readable road infrastructure for safe driving and the application of the new technologies.

ETSC European Transport Safety Council 25 YEARS 1993-2018

ECF EUROPEAN CYCLISTS' FEDERATION

EUROPEAN UNION ROAD FEDERATION ERF

ETF

TISPOL European Traffic Police Network

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RMT3.0
TRYING TO CONNECT THE DOTS

- Retroreflection night dry/wet
- Daytime luminance
- Skid resistance
- *Geometry* (length, width, gap)
- *Coverage %* (wear)

When is a road marking visible? For whom?

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ALL CRUCIAL PERFORMANCE PARAMETERS IN ONE SCAN – BY ADDING A SECOND LASER

- Retroreflection night dry/wet
- Daytime luminance
- Skid resistance
- *Geometry* (length, width, gap)
- *Coverage* (wear)

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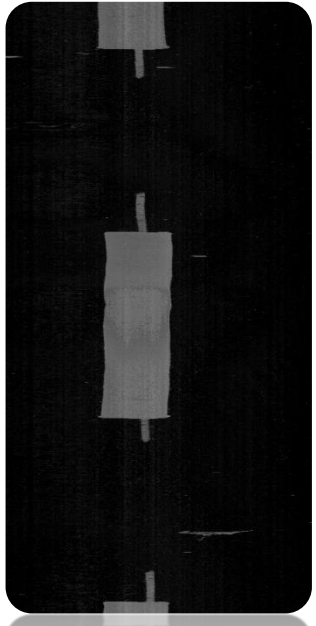
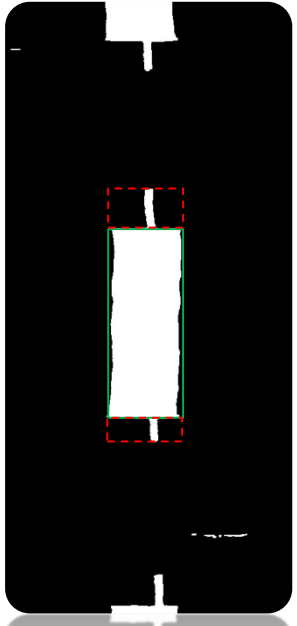
CHALLENGES OF EDGE ISOLATION





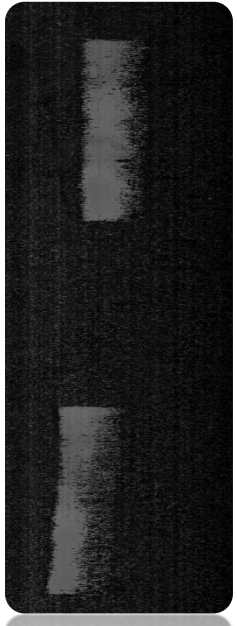
Old markings

New markings

Not same interests

Not same challenges

Theoretic database!



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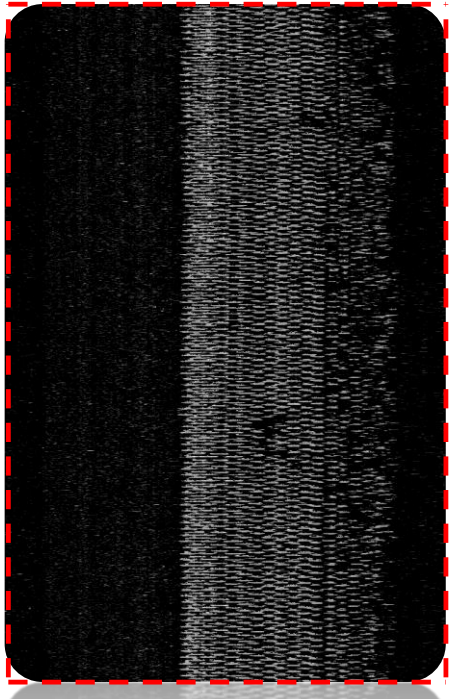
ROAD MARKING TYPES ALMOST UNLIMITED



Worn?

Maximum coverage?

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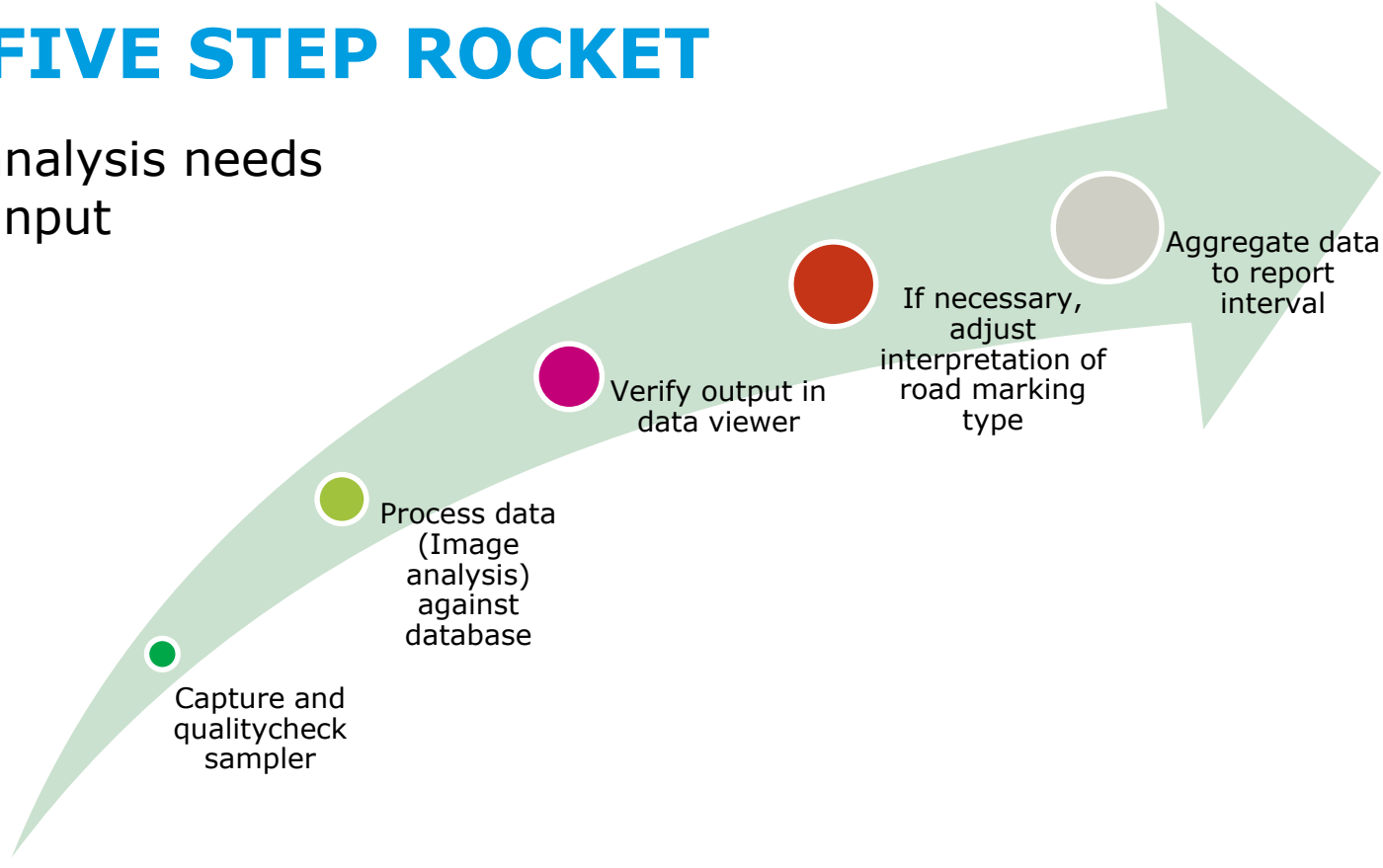
THE FIVE STEP ROCKET

Image analysis needs human input



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COVERAGE EXTERNAL VALIDATION (VTI) 2018

, tabellen nedan redovisas uppmätta värden samt noggrannhet och precision per mätobjekt.

Objekt	$Tgrad_{mobil,}$ mätning 1	$Tgrad_{mobil,}$ mätning 2	$Tgrad_{ver.}$	Noggrannhet (procentenheter)	Precision (procentenheter)
2	59	62	60	1	3
4	88	82	97	9	6
6	76	66	99	23	10
9	95	99	92	3	4
10	87	86	84	3	1
11	91	92	93	1	1
12	93	95	97	4	1
14	107	107	107	0	0
15	95	93	95	0	2
16	92	95	97	5	3
Medel	*88*	*88*	*92*	*5*	*3*

10 objects on different marking types, five systems

Validity: **5 - 9 percent**

Repeatability: **2 - 6 percent**

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RMT3.0 GOING ON 4.0

CONNECT TO ADAS -> RMT 4.0

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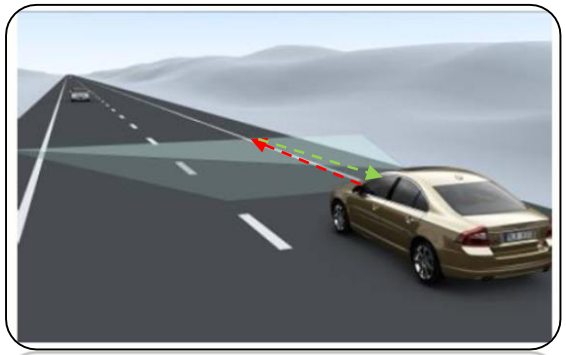
RMT4.0 FOR ADAS SUPPORT
NOW CONNECTED WITH MOBILEYE™



Minimum marking performance in order for cars to assure functionality?

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Joint Statement on Revision of the Road Infrastructure Safety Management Directive 2008/96

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- Retroreflection nighttime dry/wet
- Daytime luminance
- Skid resistance
- Geometry (length, width,gap)
- Coverage % (Wear)
- **ADAS visibility!**

THANK YOU

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THANK YOU

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Till vänster Dyngrakan innan ommålningen, till höger den ommålade versionen. Foto: SVT/Lasse Carlsson

Visa alla (3)

Försök att räta upp Dyngrakan misslyckades

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