



Belgian Road Research Centre
Together for sustainable roads



CAV & Road Safety

15.04. 2024

Lunch presentation

@the Research Village Associations Stand

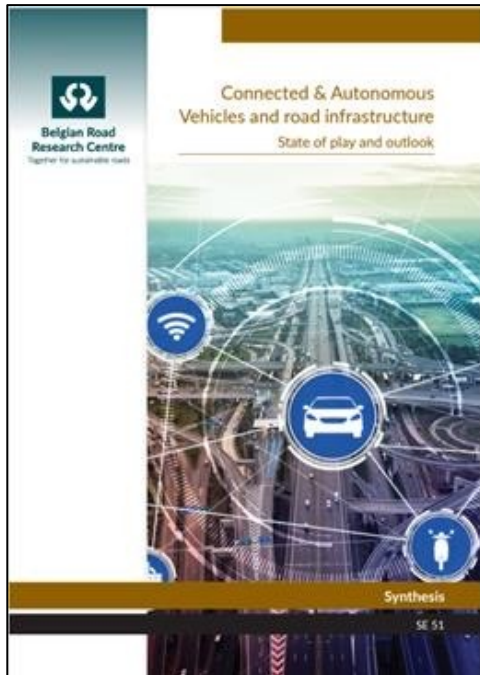
BRRC & AV

focus: **road infrastructure**

National

WG CAV

BRRC lead, external experts



2022



2024

WG vehicles & road infrastructure

BRRC lead, external experts

start in 2024

Taskforce AV Flanders

- BRRC as member

start in 2023

International

Communications

TRA2022

TRA
TRANSPORT RESEARCH ARENA
LISBON 2022

POSTER SESSION

Hirko van Geelen

CAV & road infrastructure – state of play & outlook

A study conducted by
Belgian Road Research Centre
Together for sustainable roads

Examiné scenarios

- the co-existence scenario, with different SAE level vehicles using road infrastructure;
- the full autonomous scenario.

Theme 1 – motorways
design guidelines / road construction / road equipment

Theme 2 – urban mobility
CAV as a challenge between other challenges
emerging micromobility / driving systems / growing of transport / speed limit adjustments / digital infrastructure and services / slow mobility and accessibility / diversification of public transport services / delivery goods

Theme 3 – shuttles
scope / topics / developments / infrastructure

Some conclusions

It is useful to focus on measures that make sense for autonomous cars AND for human drivers. Examples:

- harmonization of traffic signaling;
- good legibility of signaling for vehicle sensors and human drivers;
- sufficient road surface quality for driving comfort and to avoid false obstacle detections.

When constructing new infrastructure or major modification works, it is wise to provide space for later adjustments (change of lane width, adjustment of entry and exit lanes, rush-hour lanes).

Digital maps are indispensable for the safe use of autonomous vehicles and are already deemed necessary for reliable functioning of E&A systems today. An autonomous vehicle that would rely solely on road sign recognition cannot guarantee sufficient safety.

No regret measures

Our conclusions are likely to apply several years after the publication of the report. Our aim is to provide insight into no regret measures in the field of road infrastructure.

Considering the big picture

Road infrastructure has close links with other aspects of society and the travel system. (Uncertainty and complexity, and societal evolutions (policy research and project evaluations (socially) precede the conclusions on the road infrastructure issues (signalization / road layout / road structure / road surface).

TRA2022 Lisbon

TRA2022 Lisbon

TRA
DUBLIN 2024

Connected & autonomous vehicles & road safety: the role of infrastructure

Hirko van Geelen, Kirs Radant

Belgian Road Research Centre
Together for sustainable roads

Summary

TRA2024 will be a meeting point for experts across disciplines. The contribution of infrastructure to road safety, regarding connected and autonomous vehicles.

Result

A report that provides insight into:

- the road infrastructure
- the road infrastructure
- the road infrastructure
- the road infrastructure

Some conclusions

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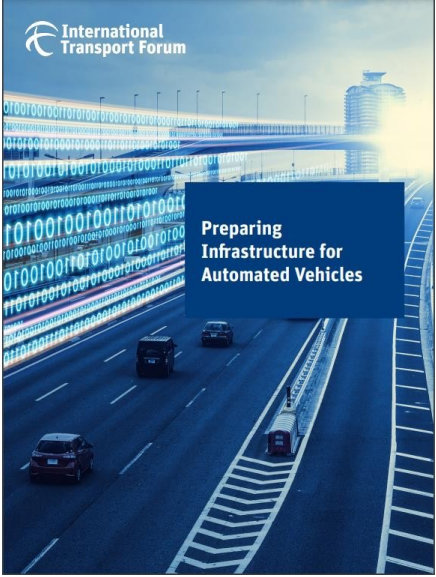
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TRA2024 Dublin

TRA2024 Dublin

IIWG
Píepaíng infíastíuctuúe
foí autonomous mobility



2023

PIARC IC2.5
Road infíastíuctuúe foí
connected & autonomous
mobility

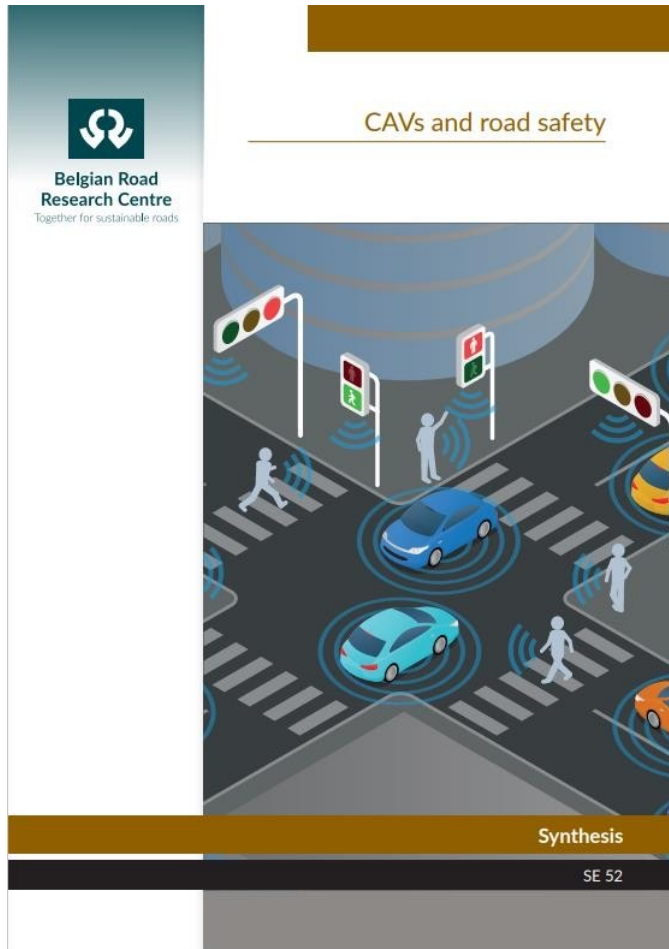


Roads foí connected, coopeá-
tive & automated mobility

Automated díiving &
infíastíuctuúe

Aíchitectuúes & business
models foí public authoíities &
íoad agencies

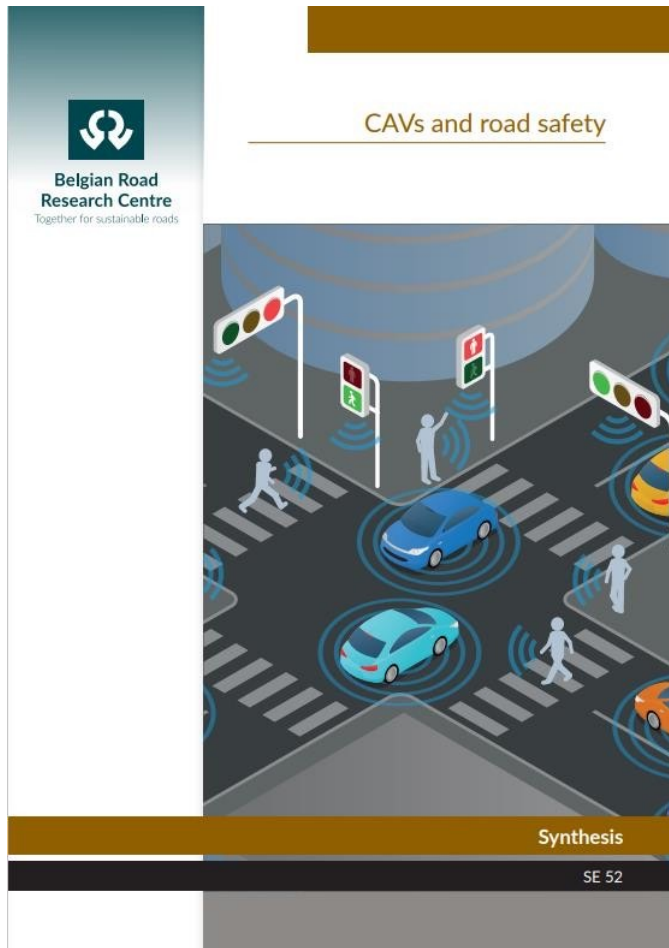
Today's lunch presentation : CAVs & road safety



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www.brirc.be

Today's lunch presentation : CAVs & road safety



a **report** that provides insight into

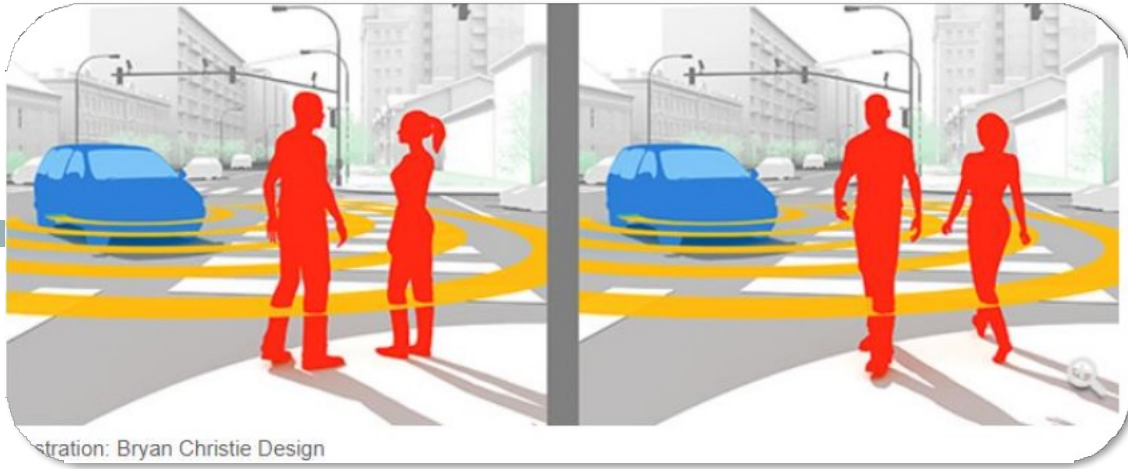
AVs **road safety**
promise

new road
safety **risks**

road safety **policies**
& objectives

AV **research**
& **testing**

infrastructure
component

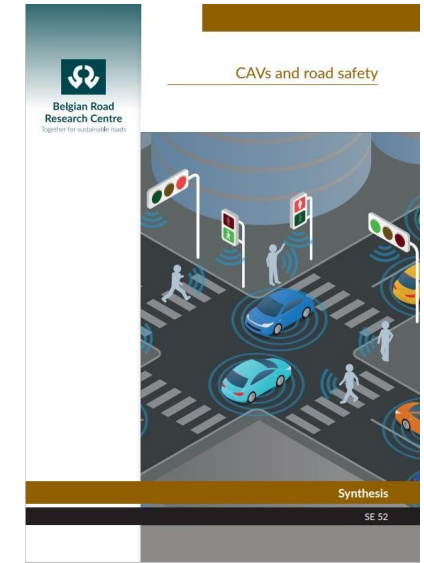


Just chatting or about to cross the road?

(Brooks, 2017)

AVs road safety
promise

new road
safety risks



Not a panacea

- potential for road safety



Non-verbal interaction

- difficult to automate

Driving skills

- gradual loss

Automation levels

- mix for a long time

Disengagements

- up to 10 seconds
- complex situations
- less initiated by AV

AV

- conservative approach
- weather conditions

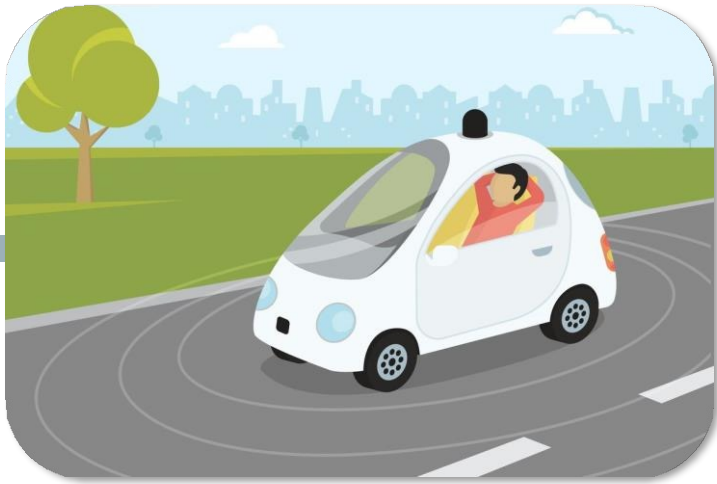
Traffic accidents

- partially: system errors

perception

decision

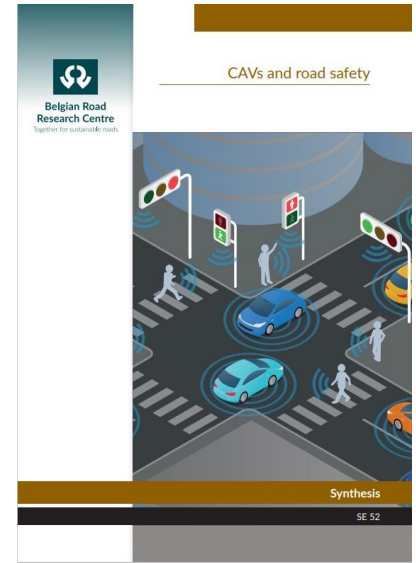
action



AV research & testing

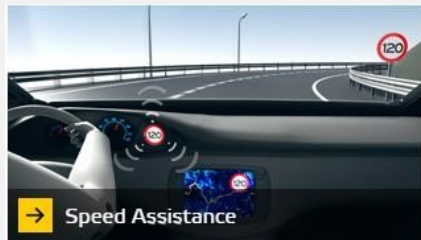
How to evaluate

- Vehicle road worthiness + driving skills
- Future : technical characteristics vehicle & systems + performance / intelligence / ...



EuroNCAP – safety assist score

- Functionality & performance



Accident statistics - simulations - test environment

- No standard method
- Each : limitations

Consumer trust

- Accidents: worldwide attention
- Error acceptance



Security

- Disagreement on connectivity dependence

infrastructure component



Considerations on

Connectivity,
CCAM,
Communication

Transferring
control

Road signs &
road markings

Digital Twin,
digital Map

Road surface &
obstacles

Emergency
refuge area

Classification of
roads

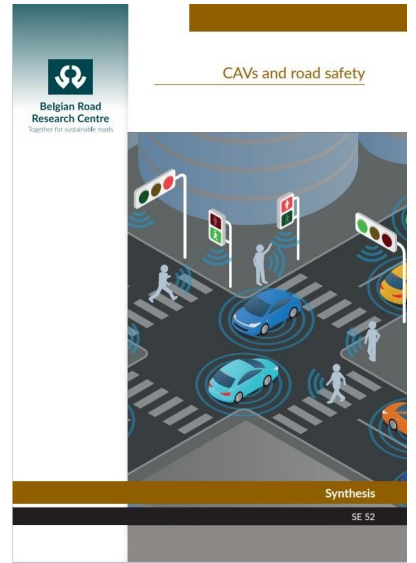
ADAS & Safe
System approach

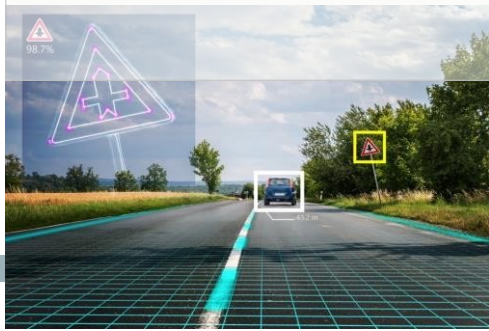
Digital
Infrastructure

Communication
AV & vulnerable
road users

Weather
conditions

Operational
Design Domain





infrastructure component



ODD – operational design domain

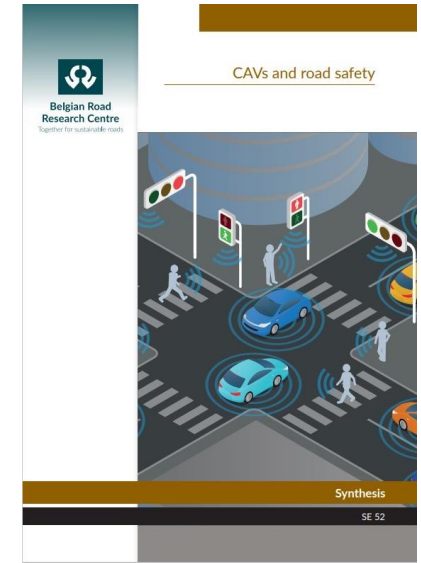
Specific circumstances under which a reliable operation of driving support or self-driving functions is guaranteed

No **formal agreements** about parameters

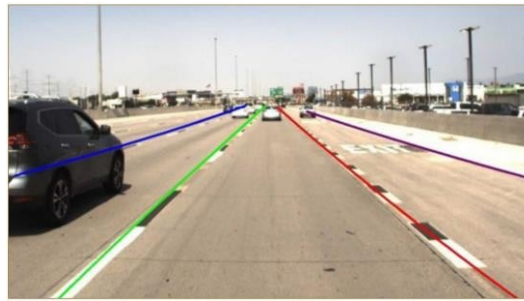
No **unequivocal standard** for **THE** road

Fair consensus among industry and policy makers that AV will use **existing roads** & construction

Different per continent



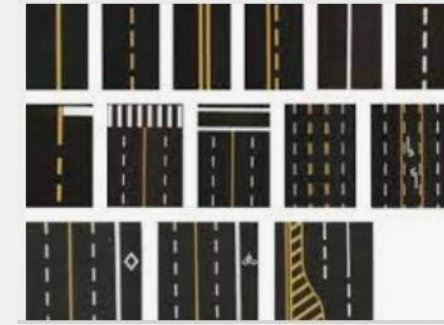
infrastructure component



Traffic signs and road markings

Importance of clear
and **uniform
signaling**

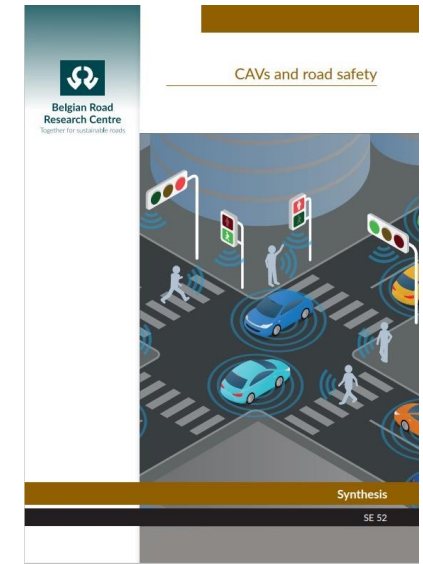
Challenging: correct reading
under **unfavorable conditions**
(bad weather, faded signs...)



Recommendations for the visibility of road
markings are not always achieved

Technological evolutions allow AV to deal
increasingly well with poor road markings

**Maintenance and
investments** in road
markings and traffic signs
remain relevant



infrastructure component



Some other concluding observations

AI

- before a hazard arises

Smart Roadside units - China

- Enabler for AD
- Easier to realize than AI

Road surface

- Defects difficult to interpret
- AV: cautious



ISA speed limit recognition

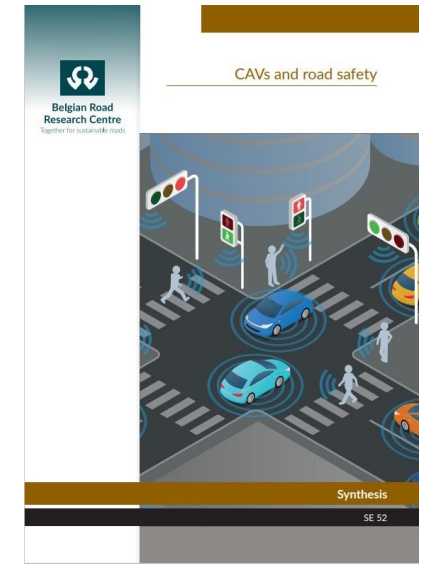
- Sign recognition reliability
- Digital maps are needed

Human factors researchers

- different views on the role of road infrastructure in relation to AV

Roadworks

- Challenge: information update
- Include in contracts?





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