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From SOTIF analysis to ADAS risk mitigation

New accident factors linked to ADAS limitations, weaknesses and misuse

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Agenda

01

Context & scope

Why this study, ADAS perimeter, L2 focus

02

SOTIF-based methodology

From function spec to risk evaluation

03

Key results

4 critical accident mechanisms

04

Root causes

Why deviations become hazards

05

Mitigation levers

Design, HMI, infrastructure, awareness

Why study ADAS-related accident factors?

- *Mandate from the French Road Safety Delegation (DSR)*

L2+

Automation level

ACC, LCA, Lane Change, ISA, DMS, RMF — the systems already deployed at scale

100%

Driver responsibility

Yet drivers regularly misread system state, overtrust capabilities, or operate out of ODD

0

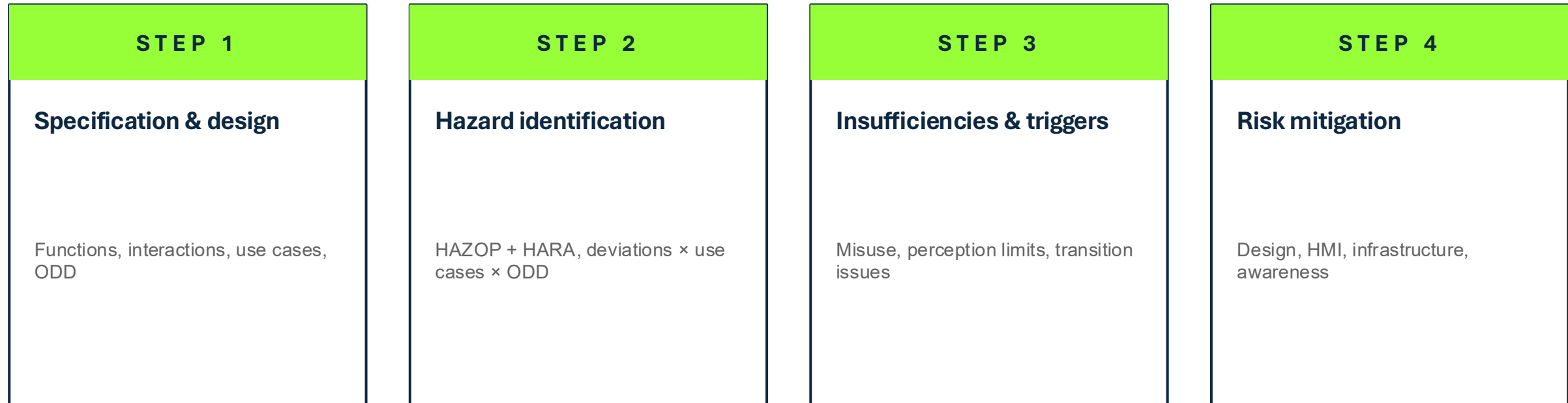
Single-cause scenarios

Hazards emerge from combinations: deviation × context × driver behaviour

Focus systems: ACC (R13H), LCA (R79), Lane Change (R79) — with ISA, DMS, RMF as secondary.

A 4-step SOTIF-based methodology


● *Generic, analytical, non-iterative — adapted from ISO 21448*



Focus: human factors and misuse (direct & indirect), not isolated hardware failures.

Hazard evaluation — three axes

● No ASIL classification — used here to prioritize, not to certify




Exposure

E1 → E4

How often does the triggering context actually occur in real traffic?

- E1 — very low
- E2 — < 1%
- E3 — 1 to 10%
- E4 — > 10%




Controllability

C0 → C3

Can the driver still avoid the accident — including under realistic misuse?

- C0 — generally
- C1 — > 99% drivers
- C2 — 90–99%
- C3 — < 90%



Severity

S1 → S3

What level of harm if the collision occurs?

- S1 — light/moderate
- S2 — severe, survivable
- S3 — life-threatening

Controllability is rated conservatively, accounting for plausible misuse.

Four critical accident mechanisms

- They appear in ordinary driving — not exotic situations

01 Rear-end on fast roads

High exposure × Low controllability

Tight cut-in, sudden upstream braking, target loss. The most critical family overall.

02 Lateral drift in curves

Low frequency × Disproportionate severity

Slow drift on degraded markings, late/over-correction in tight bends. Intrusion risk.

03 Unstable lane changes

Optimistic gap × Decision oscillation

Incomplete execution, false-positive reactions, sensitivity to differential speed.

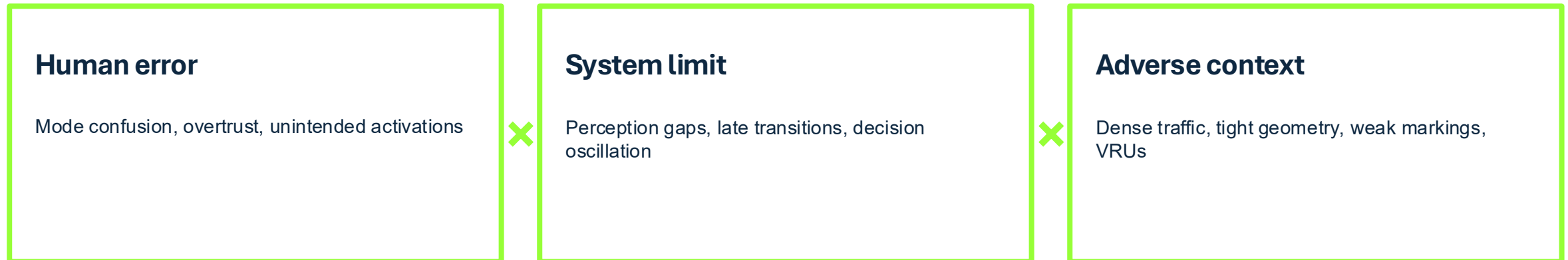
04 VRU interactions (urban)

Small latency × High severity

Cyclists, pedestrians, two-wheelers. Modest detection delays create severe outcomes.

Why do these mechanisms emerge?

- Hazards rarely stem from a single factor — they come from combinations



Transversal finding — mode and state transitions are a universal amplifier

A poorly perceived transition, a late deactivation, or a non-visible switch shifts the decision load back to the driver — precisely when time to act is shortest.

Four complementary mitigation levers

● *No single technology fix — combine design, HMI, infrastructure, awareness*

Design (ADAS logic)

- Earlier anticipation of decelerating traffic
- Bound re-acceleration after cut-out
- Modulate lateral assistance by marking confidence
- Stabilize lane-change decision logic
- Filter perception artefacts before commanding

HMI & states

- Clarify modes and transitions persistently
- Prevent unintentional engagements
- Pre-warn earlier near limits of validity
- Anti-overtrust contextual prompts

Infrastructure

- Reinforced retroreflective markings
- Vibrating strips on drift-prone segments
- Early geometry & speed signaling
- Readable work zones (no ghost markings)

Awareness & training

- Vehicle handover briefings
- Embedded contextual reminders
- Campaigns on overtrust & state confusion
- Realign expectations with actual capability

Key takeaways

● *From this study, for the road safety and ADAS community*

01

Critical scenarios are ordinary, not exotic

Dense traffic, tight curves, weak markings, urban VRUs — that is where ADAS limits meet driver behaviour.

02

Single-cause thinking misleads

Risk comes from human × system × context. Mitigation must be multidimensional too.

03

Transitions are a universal risk amplifier

State changes need dedicated treatment in design, HMI, and validation.

04

SOTIF analysis is actionable today

Even non-iterative, it produces a structured roadmap: short-term HMI, medium-term logic, long-term fusion.

Thank you.

Questions & discussion welcome.

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