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Occupant status monitoring: A framework to integrate human factors, technology and policy to realise injury reductions across the safety chain

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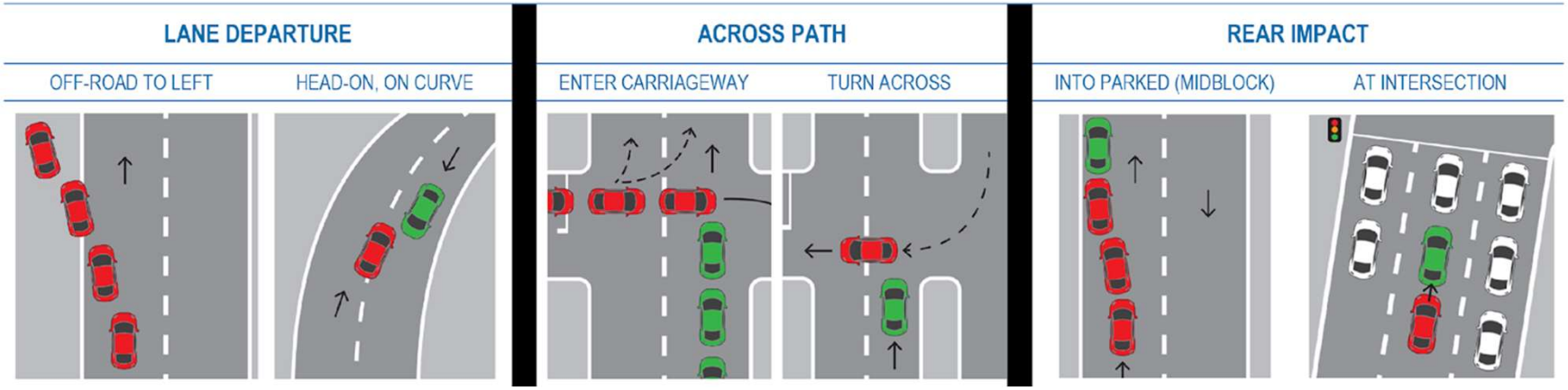
Revisiting DDI 2022: The inattention *crash* problem



Inattention [drowsiness]	50% [39%]	46% [12%]	64% [7%]
Sudden Sickness*	19%	9%	22%
Alcohol & Illicit drugs	42%	12%	7%

Source: Fitzharris, Lenne et al. (2020). Overview and analysis of serious injury crashes – crash types, injury outcomes and contributing factors, ECIS Report 1 (MUARC Report 343). Available at: https://www.monash.edu/muarc/research/research-areas/transport-safety/enhanced-crash-investigation-study/ecis-reports

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Measuring risk objectively from external sensing is pretty mature

- Objective metrics related to (e.g.,) headway and lane departure are related to crash risk
- These measures are reliably measured in real-time in automotive applications
- Crash avoidance interventions are available globally to reduce crash occurrence.

A key question we address here:

What is the driver's perception of risk, and how does this influence safety outcomes?

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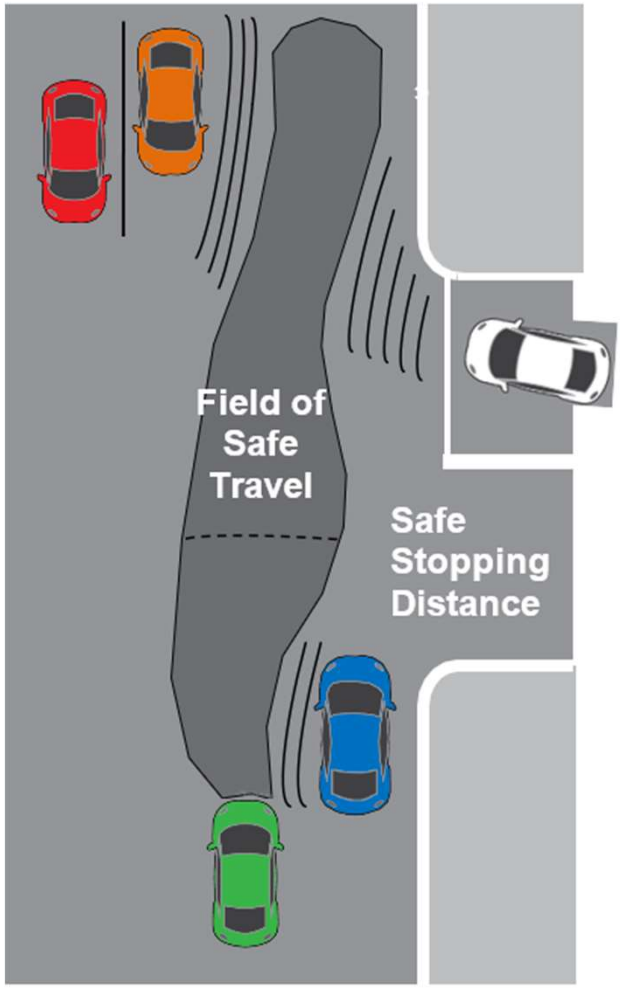
Representing subjective risk through the Field of Safe Travel (FoST)

- FoST is one approach (rough take on TTC)
- While the value in FoST historically is largely conceptual and illustrative, it is experiencing a resurgence
- Examining driver attention is a key to gaining greater insight into a driver's perception of risk
- Until recently, using technologies such as eye tracking to explore driver attention was only possible in research studies.



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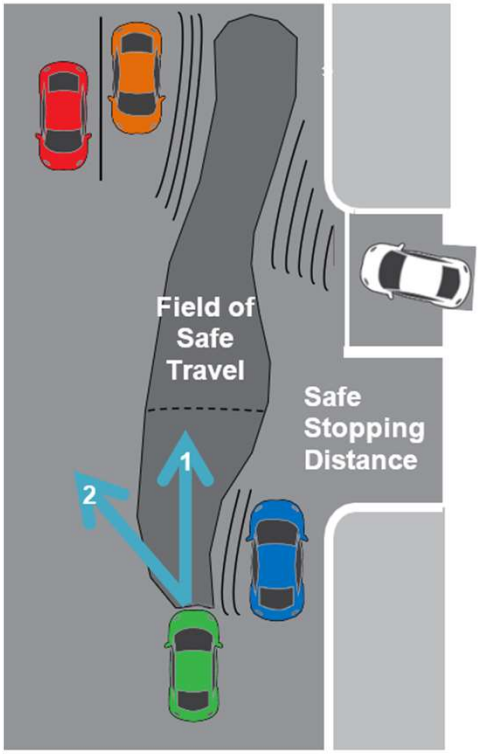
The opportunity to address occupant behaviour and subjective risk

Current regulations and policy are encouraging implementation of Occupant Status Monitoring (OSM) solutions to address driver inattention



What are the opportunities to improve safety and experience?

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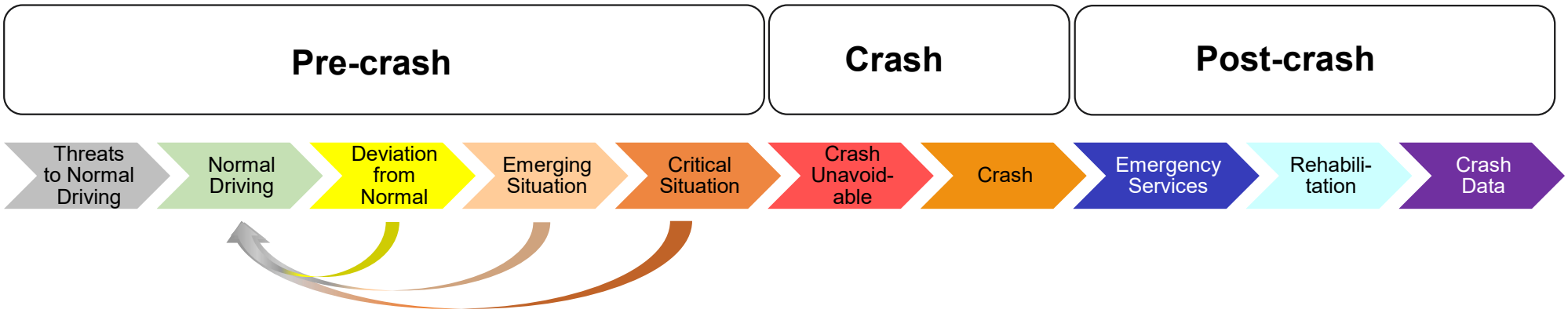
Considering implications across the Integrated Safety Chain



Measures to promote and return a driver to Normal Driving

Measures that promote energy reduction and injury mitigation

Measures that promote immediate post-crash care, rehabilitation and reporting

Fitzharris, M., Corben, B., Lenne, M. G. et al. (2022). Understanding Contributing Factors for Serious Injury Crashes Using Crash Chain Analysis: ECIS Report 3 (MUARC Report 345). Available at: https://www.monash.edu/muarc/research/research-areas/transport-safety/enhanced-crash-investigation-study/ecis-reports

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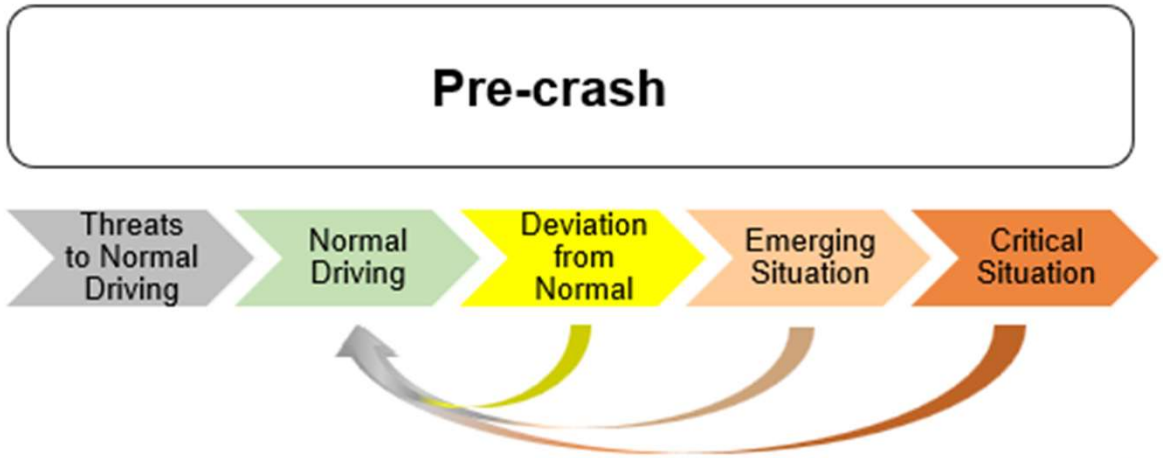
Considering HMI elements for PRE-CRASH only



Critical HMI characteristics

Urgency	Increases approaching the critical situation
Intervention type	Warning only ⟷ Warning + ADAS intervention
Warning modality	Likely visual with additional cues as urgency increases
Performance	Increasing performance requirements

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HMI opportunities

Attentive Driver

Inattentive Driver

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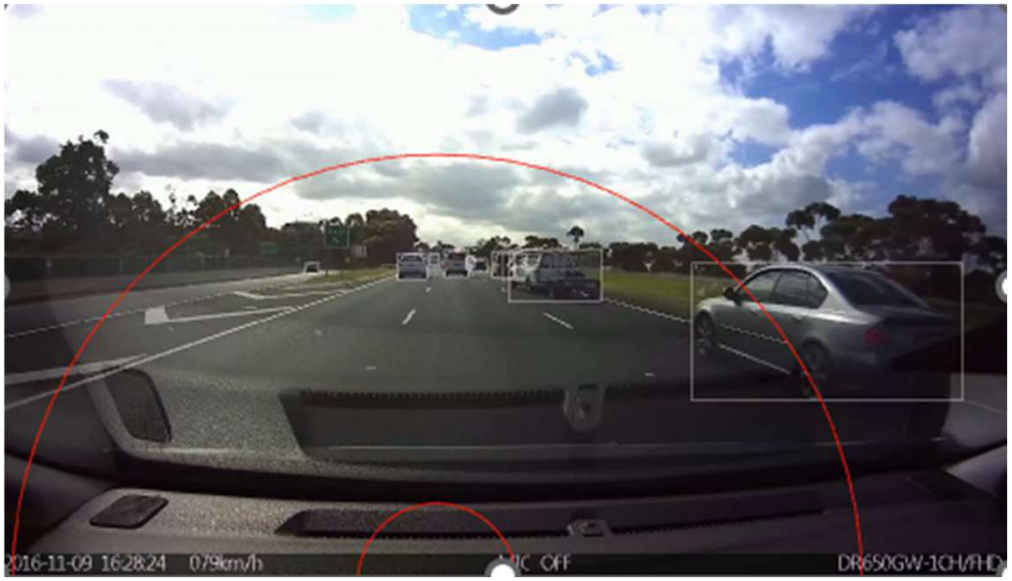
Note: Videos removed for pdf

HMI opportunities

Attentive Driver



Inattentive Driver

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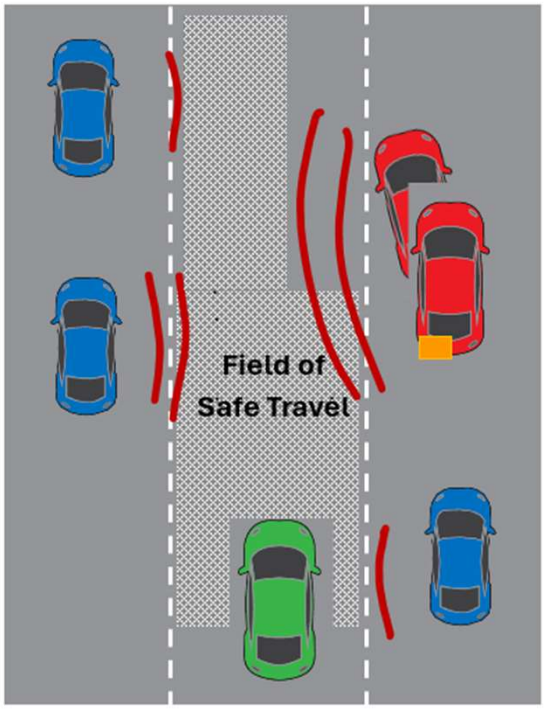
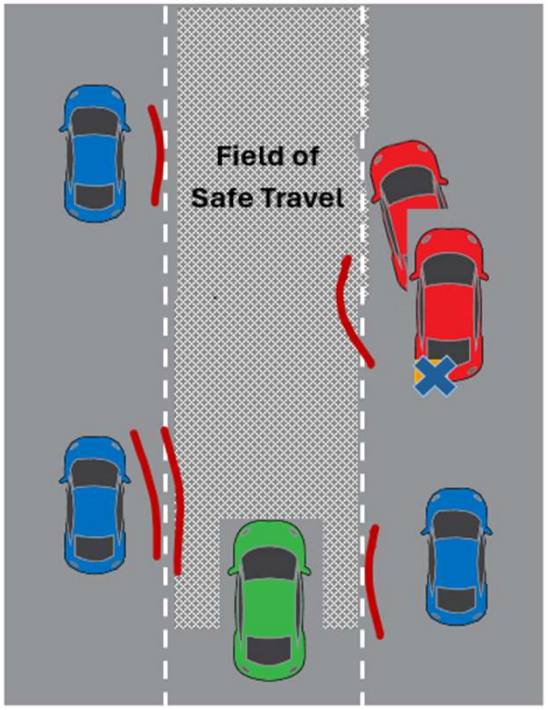
Risk and HMI Implications



#1 - Attentive Driver



#2- Inattentive Driver

Potential HMI differences

- **Urgency** is increased when driver attention is compromised
- Intervention **timing** can adopt functional suppression (`#1) or functional adaptation (#2)
- When attention is off-road, **warning strategy** can adopt directional cues to re-orient attention more rapidly.
- **Better driver experience, acceptance and thus safety outcomes**

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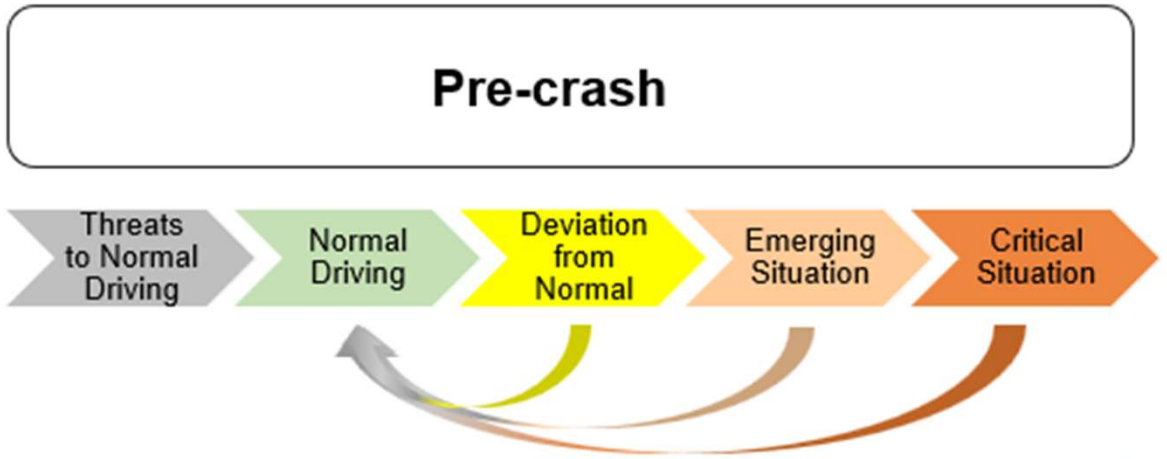
Considering HMI elements for PRE-CRASH only



Critical HMI characteristics

Urgency	Increases approaching the critical situation	Better managed
Intervention type	Warning only ⟷ Warning + ADAS intervention	More flexibility
Warning modality	Likely visual and SPATIAL cues as urgency increases	Better re-orientation
Performance	HIGH performance requirements	Requires > performance

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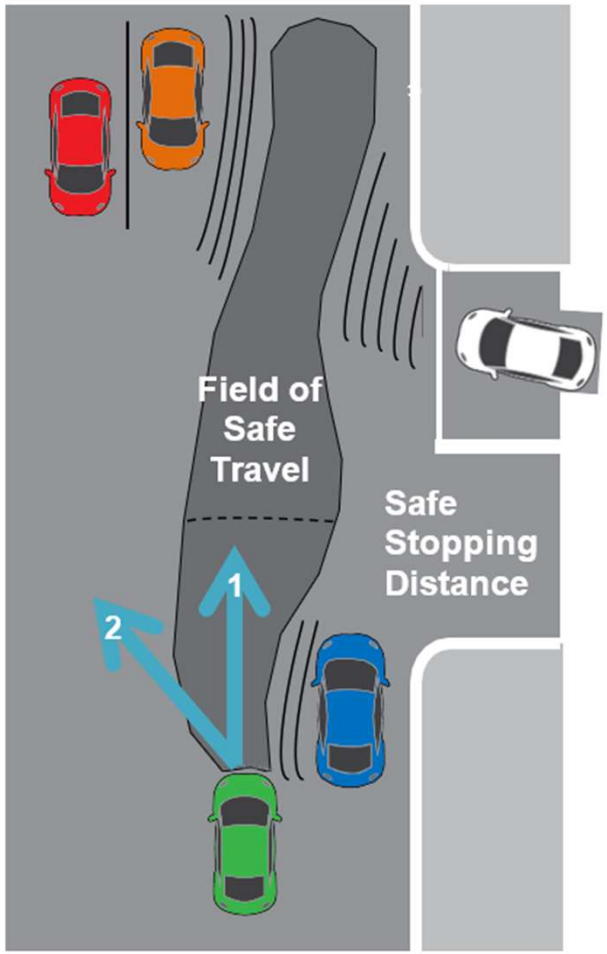
Extending the application of FoST

- FoST is a powerful illustration of subjective risk, can it be extended?
- Evolution of FoST to express it in more objective terms
- Explore opportunities to build driver situation awareness
- Driver coaching / training applications
- Continued development of cabin perception to evolve attention management



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Conclusion

Key Messages:

- The importance of the core ADAS suite remains
- The fusion of internal OSM and external vehicle sensors affords new safety and acceptance opportunities.

Application Opportunities:

- Crash avoidance enhancements through more targeted HMI design and implementation
- HMI design that achieves these elements will be more accepted by vehicle occupants and is expected to deliver better safety outcomes

Research & Technology Opportunities:

- Evolution of FoST to express it in more objective terms
- Exploring opportunities to build driver situation awareness & coaching / training applications
- Applications right across the integrated safety chain to drive safety outcomes

Thank you

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