Safety assurance of automated driving systems. Raising the level of ambition

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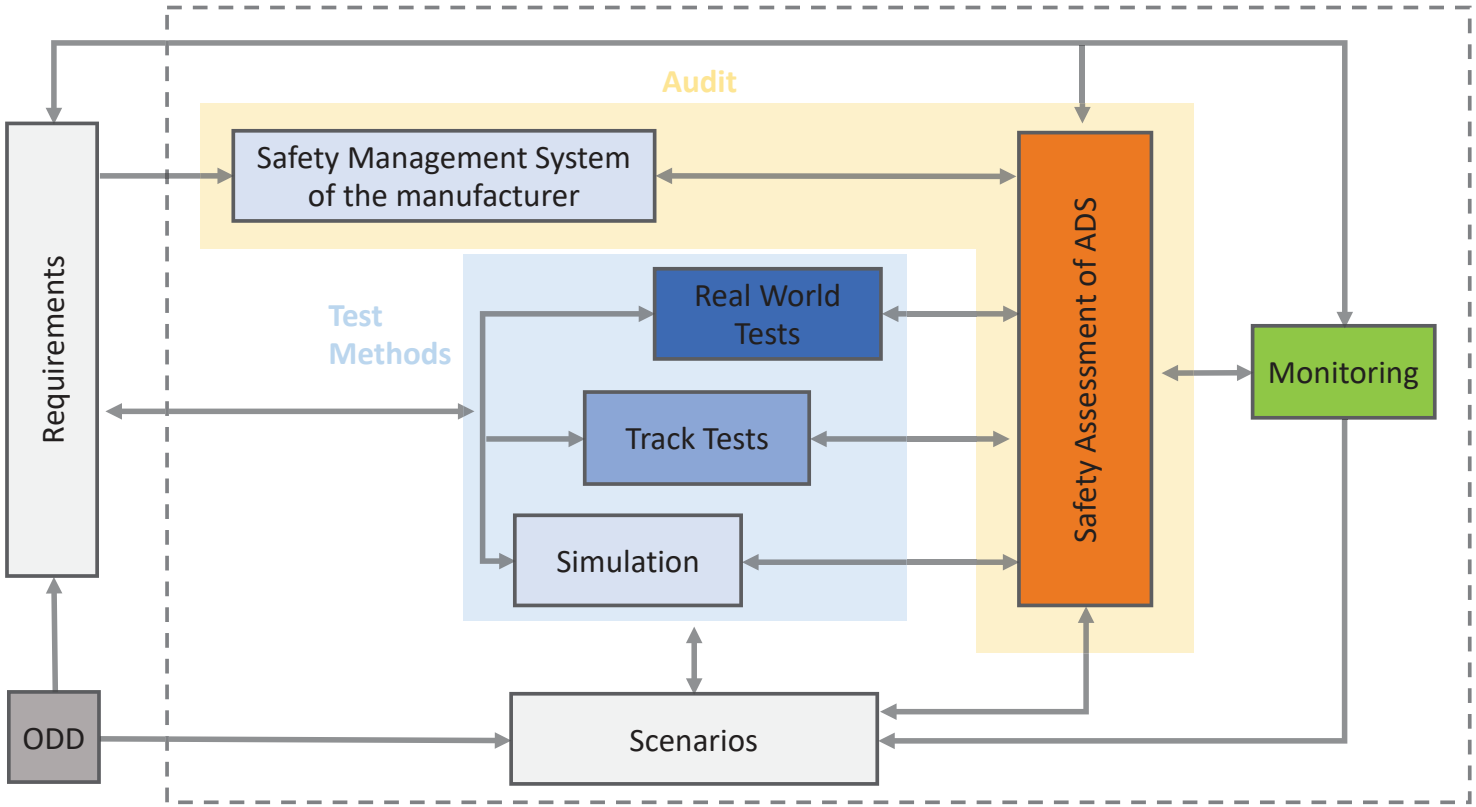
Assessment of ADS safety in GRVA/VMAD*



* *VMAD-13-03 NATM MASTER DOCUMENT*

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Example: ALKS Regulation 157

- Requirements. The activated system shall:
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Operational requirement

Present speed of the ALKS vehicle		*Minimum time gap*	*Minimum following distance*
(km/h)	(m/s)	(s)	(m)
7.2	2.0	1.0	2.0
10	2.78	1.1	3.1
20	5.56	1.2	6.7
30	8.33	1.3	10.8
40	11.11	1.4	15.6
50	13.89	1.5	20.8
60	16.67	1.6	26.7

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Performance requirement

- avoid a collision with a cutting in vehicle if If the cutting in vehicle is 30 cm inside the lane and

$$TTC > \frac{u_{rel}}{6 * 2} + 0.35\ s$$

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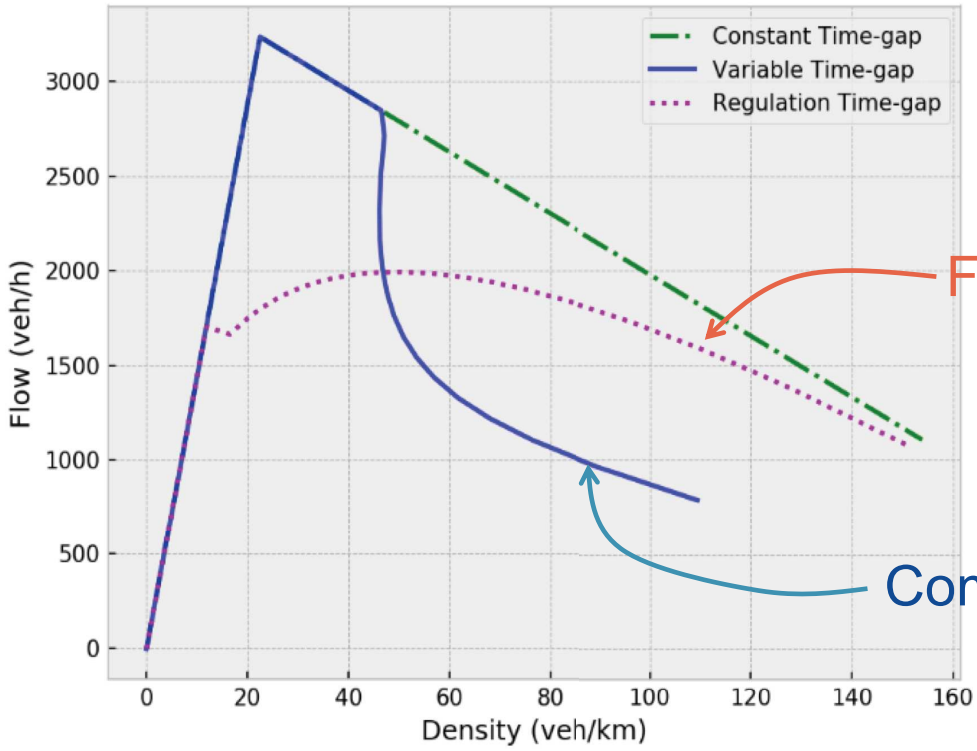
Effect of operational requirements. Example

Traffic fundamental diagram



Future ALKS

Commercial ACC

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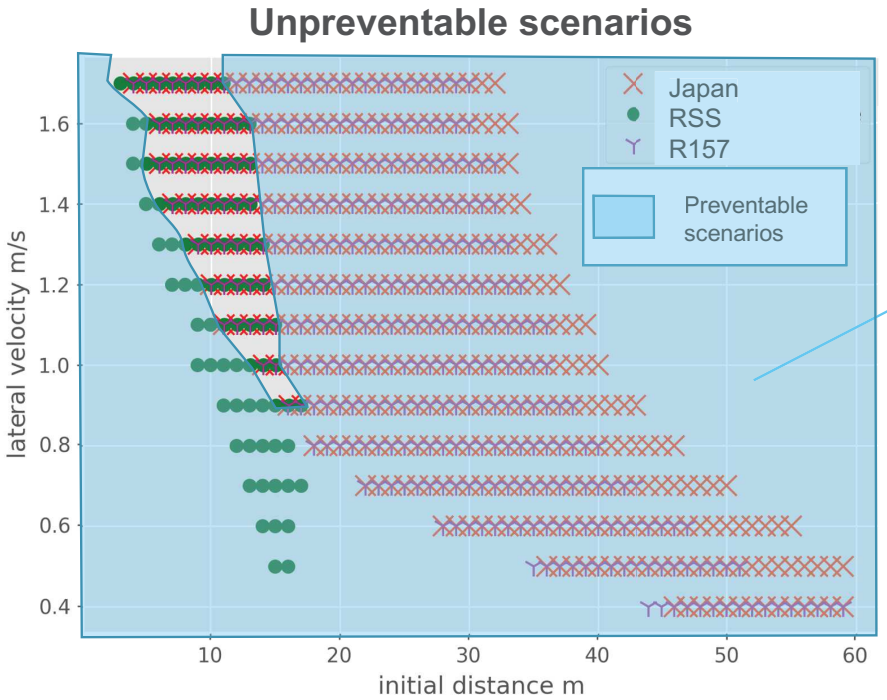
JRC recommendation

- Focus on **performance** rather than behavioural/operational **requirements**

- **Combine different approaches in a transparent way** to set the performance level (human behaviour, technological capability, physical boundaries)

- Adopt a **statistical approach to assess** the requirements (models are not perfect)

Comparison between RSS and VMAD Driver



- **Unpreventable scenario are those where both the validated driver model and the safety envelope approach produce an accident**
- **An ADS cannot be less safe than a human and shall take advantage of the available technologies**

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Conclusions

- Setting operational requirements can induce **negative effects on traffic flow** which are difficult to be foreseen and can **limit technlogical capability** to improve both safety and traffic efficiency
- Performance requirements have to be set in **a transparent and credible way** to clearly define the level of ambition for future Ads. Different approach can be combined in order to exploit their benefits and cope with their limtations
- Performance requirements should be used to **define accident probability** on the set of scenarios used rather than to define which scenario is preventable
- A safety margin should be used to define **of how much an ADS should be safer** than a human driver supported by state-of-the-art technologies

Thank you

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