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Comparative Analysis of Liability Frameworks for Automated Vehicles

Legal Readiness in the
EU, US and China

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Introduction

Expected **benefits** of CAVs are substantial:

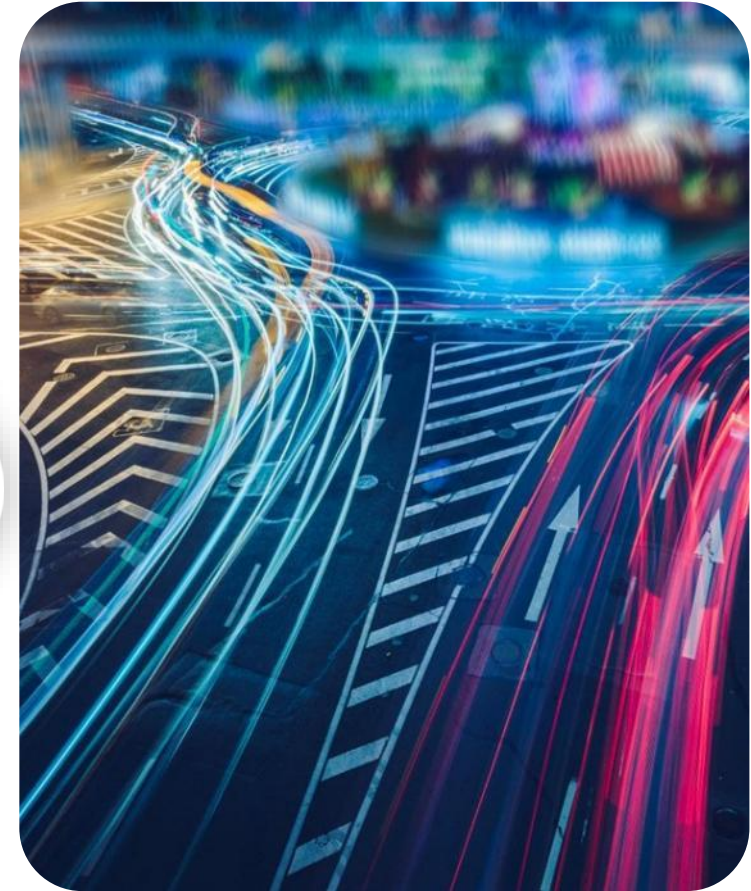
- Up to 90% fewer human-error crashes.
- Reduced congestion especially when CAVs represent more than 50% of vehicles.
- Enhanced fuel economy.
- Increased mobility.

Mixed traffic and L3-L4 handovers make responsibility harder to assign. The path to deployment is shaped not only by technology, but by accountability and public legitimacy.



Objectives

- **Current legal regimes** were set up with the idea that a human driver is the primary decision-maker and are **insufficient** when control is shared or transferred between human and vehicle
- **Limited precedent** for allocating fault in mixed-traffic environments,
- Increased **uncertainty** about evidence, transparency and explainability
- **Unclear liability** can slow adoption, raise insurance costs and reduce public trust.
- Investigate **legal readiness of the EU, US and China** regarding liability allocation when AVs at Levels 3-5 are involved in crashes.



Regulations Evaluation Framework

Each jurisdiction regulations were evaluated based on three dimensions:

1

Clarity

Does the framework identify the liable actor, distinguish human vs system control, and require evidence such as event data recorders?

2

Coherence

Are product, traffic, insurance and safety rules internally consistent across legal instruments and levels of government?

3

Adaptability

Can the rules keep up with Levels 3-5 automation, software updates, data governance and cross-border deployment?

AVs Liability Framework in the EU

Assessment: coherent manufacturer/insurance baseline at EU level, but Member-State traffic rules still create uncertainty - especially for L3-L4 handover and standardized data access.

Product Liability Directive 2024

Strict liability for defective products supports claims against manufacturers.

Motor Insurance Directive

Victims are compensated through compulsory motor insurance, with possible recourse upstream.

AI Act + Type Approval

Ex ante risk controls and ADS type-approval improve safety governance, but do not fully allocate civil liability.

AVs Liability Framework in the US

Assessment: robust legal tools, but decentralized rules create uncertainty for end-users, manufacturers and insurers across states.

Federal Level NHTSA

Safety oversight, defect enforcement, model guidance for AV deployment

State Level

Tort law, negligence, product liability and insurance design vary state-by-state

L3 uncertainty: Misuse, overtrust and poor warnings generate shared-liability debates.

Few states clearly legislate when responsibility shifts during handover.

AVs Liability Framework in China

Assessment: progress is fast, but local divergence remains high - especially on L3 driver duties, manufacturer obligations, software updates and crash-data retention.

National Level

Road-testing and pilot guidance exist, but there is no fully unified AV liability rule yet.



Shenzhen

L3-L4: driver often compensates
L5: owner/manager first

Beijing

Liability linked to whether the automated system was activated

Other pilots

Some cities move toward enterprise liability for unmanned operation

Comparative analysis across jurisdictions

Aspect	EU	US	China
Core architecture	Most coherent baseline: product liability + compulsory insurance + AI/risk rules	Federal safety oversight; liability and insurance mainly state-based	Central direction plus diverse local pilot rules
Main L3 challenge	No uniform EU-wide handover standard	Few clear statutory handover triggers across states	Activation, takeover and attention duties differ by city
Evidence / data	Better direction, but data-access rules are still uneven	No uniform AV-EDR rule for liability	No unified nationwide crash-data rule yet
	Coherent	Decentralized	Pilot driven

Policy Recommendations for the EU

- **Clear separation between L2 and L3+:** Define when the vehicle is truly “driving itself” and make status signals machine-readable.
- **Set minimum handover standards:** establish HMI/transition-demand rules and a safe reaction window before fault shifts to the human.
- **Standardize evidence:** ensure access to ODD status, takeover requests, minimum risk manoeuvre logs and other liability-focused data.
- **Harmonize recourse after compensation:** Victims should be paid quickly by motor insurers, with structured recovery pathways against manufacturers when defects exist.



Conclusion

Product liability remains central across all three jurisdictions.

Insurance as the first compensation layer: victims need fast payment before upstream disputes are resolved.

Reliable data for causation: Control status, takeover logs and event data are essential to assign responsibility fairly.

Comparative analysis suggests that clearer **L3 rules** and shared **evidence standards** are the next policy priority.



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