

RESPONSIBILITY
ASSESSMENT STANDARDS
for ASSISTED/AUTOMATED
VEHICLES

AVs will crash

There is little crash frequency/severity data on any AVs

Insurers have no crash data on which to price and provide coverage

Q: Are there data sets insurers can use to understand and allocate responsibility for AV crashes?

These
Exist
NOW

These
MAY
Exist
Later...

These
Exist
NOW

- If the **dynamic driving tasks** - *the real-time operational and tactical functions required to operate a vehicle* cannot be controlled by the vehicle, human driver will be responsible.
- If the **dynamic driving tasks** of the vehicle can only be controlled by the vehicle, then the automated driving provider will be responsible.
- If the **dynamic driving tasks** of the vehicle can be controlled at times by the vehicle and at times by the occupant – “dual control” - then



There are a number of projects underway to define a target of what “safe driving” can be and most focus on the – to be developed - fully autonomous SAE Level 5

The purpose of this project is to define the data that insurers and law enforcement need NOW to determine responsibility for crashes in vehicles with both driver and machine driving capabilities

RESPONSIBILITY ASSESSMENT is more than just allocating financial accountability for crashes

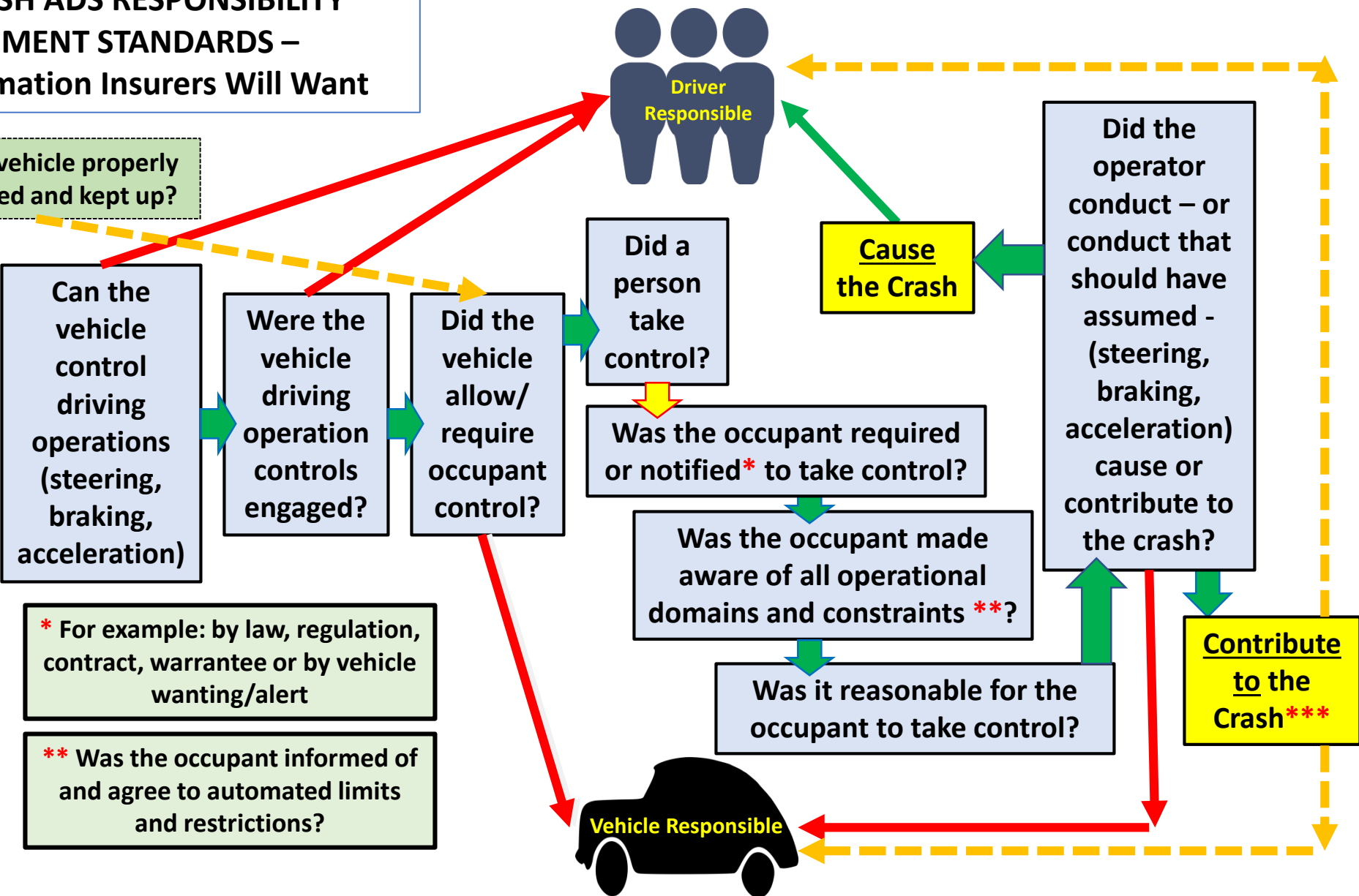
RESPONSIBILITY ASSESSMENT directly improves safety by identifying the root causes of crashes which enables remedial changes to prevent future crashes

**POST-CRASH ADS RESPONSIBILITY
ASSESSMENT STANDARDS –
Data/Information Insurers Will Want**

Key:
Yes
No

CRASH

*** Was vehicle properly maintained and kept up?



* For example: by law, regulation, contract, warrantee or by vehicle wanting/alert

** Was the occupant informed of and agree to automated limits and restrictions?

Query 1 – Who among the Occupants is the “Responsible Person”?



- The owner? The owner’s agent?
- The person with the agreement with the ridesharing company (the “Client) ?
- Are these people required to be licensed and competent drivers?
- Does the ADS have any pre-operation responsibility to verify the license or competence?

Query 2 - ADS Upkeep/Update/Maintenance

Auto policies often pay for damages caused by the insured's maintenance of the described auto or a non-owned auto.

If the vehicle did not allow or require the occupant to take control, or notify the occupant, was that because:

1. The insured had failed to maintain (i.e. update software or sensors) the vehicle, or
2. There was a defect in the vehicle's operating system?

Did the vehicle allow/require occupant control?

Was the occupant made aware of all operational domains and constraints **?

Cause
the Crash

Did the operator conduct – or conduct that should have assumed - (steering, braking, acceleration) cause or contribute to the crash?

Contribute
to the
Crash***

**POST-CRASH ADS RESPONSIBILITY
ASSESSMENT STANDARDS –
Data/Information Insurers Will Want**

Using this **methodology** to determine ADS
crash responsibility –

What **data sets** can insurers use to help
price and provide the requisite insurance
coverage for ADS owners and operators ?

A. Can the vehicle control driving operations?

B. Were the vehicle driving operation controls engaged?

C. Did the vehicle allow/require occupant control?

D. Did the occupant take control?

E. Was the occupant required or notified to take control?

F. Was the occupant made aware of all operational domains and constraints ?

G. Was it reasonable for the occupant to take control?

H. Did the operator control cause or contribute to the crash?

What data on the functions above are recorded, retained and/or reported?

Where is that recorded, retained and/or reported data accessible?

How is that recorded, retained and/or reported data accessible?

For what period is that recorded, retained and/or reported data accessible?

Who is authorized to access that recorded, retained and/or reported data?

A. Can the vehicle control driving operations (steering, braking, acceleration)?

1. What driving operations is the ADS of vehicle designed to control?

Steering ____ Braking ____ Acceleration ____ Other _____

2. Is the vehicle designed to inform the occupant as to which controls of driving operations the ADS is and is not controlling?

3. Which dynamic driving tasks - the real-time operational and tactical functions required to operate a vehicle in on-road traffic – is the ADS of vehicle designed to control?

- Lateral vehicle motion control via steering (operational);
- Longitudinal vehicle motion control via acceleration and deceleration (operational);
- Monitoring the driving environment via object and event detection, recognition, classification, and response preparation (operational and tactical);
- Object and event response execution (operational and tactical);
- Maneuver planning (tactical);
- Enhancing conspicuity via lighting, signaling and gesturing, etc. (tactical);
- Other _____

A. Can the vehicle control driving operations (steering, braking, acceleration)?

4. What are the permissible operational design domains of the vehicle – i.e. the specific conditions under which the ADS is designed to control driving operations?

Environmental

Geographical

Time-of-day restrictions

Requisite presence/absence of traffic or roadway characteristics

Other _____

5. What are the operational design limitations and constraints – the conditions under which the ADS of vehicle is **not designed to control driving operations?**

Environmental

Geographical

Time-of-day restrictions

Requisite presence/absence of traffic or roadway characteristics

Other _____

B. Were the vehicle driving operation controls engaged?

1. What driving operations are the ADS of the vehicle designed to control?

Steering ____ Braking ____ Acceleration ____ Other _____

2. Are these ADS of the vehicle driving operations controls designed to be engaged automatically or by the occupant?

Steering: Automatically ____ By the Occupant ____ Braking: Automatically ____ By the Occupant ____
Acceleration: Automatically ____ By the Occupant ____ Other: Automatically ____ By the Occupant ____

3. How are the ADS of the vehicle driving operations controls designed to be engaged or disengaged?

- a) Steering
- b) Braking
- c) Acceleration
- d) Other

B. Were the vehicle driving operation controls engaged?

4. What preconditions – if any – is the ADS designed to require for the vehicle driving operations for controls to be engaged or disengaged?

- a) Steering
- b) Braking
- c) Acceleration
- d) Other

5. Is the system designed to notify occupants notified of the driving operations controls that are engaged and not engaged by the ADS of the vehicle?

6. Is the system designed to notify occupants notified of the Operational Design Domains and limitations of the ADS of the vehicle?

7. Is the system designed to notify occupants of the vehicle operation outside the Operational Design Domains?

C. Did the vehicle allow/require occupant control?

1. What driving operations is the ADS of the vehicle designed to control?

Steering ____ Braking ____ Acceleration ____ Other _____

2. When the vehicle ADS is controlling any driving operation, is the ADS designed to allow occupants to mutually control that same driving operations?

3. When the vehicle ADS is controlling steering driving operations, is the ADS designed to allow occupants to control other driving operations?

a) ADS Steering Control is Engaged:

ADS only Steers ____

Occupant Steering ____

Occupant Braking ____

Occupant Acceleration ____

Other _____

C. Did the vehicle allow/require occupant control?

3. When the vehicle ADS is controlling steering driving operations, is the ADS designed to allow occupants to control other driving operations?

b) ADS Braking Control Engaged

ADS only Brakes ____

Occupant Steering ___

Occupant Braking ____

Occupant Acceleration ___

Other _____

c) ADS Acceleration Engaged

ADS only Accelerates ____

Occupant Steering ___

Occupant Braking ____

Occupant Acceleration ___

Other _____

C. Did the vehicle allow/require occupant control?

4. Which dynamic driving tasks vehicle of ADS driving operations controls are designed to be voluntarily disengaged by occupants?

Steering ____ Braking ____ Acceleration ____ Other _____

5. Which dynamic driving tasks of ADS driving operations controls are designed to be disengaged by the ADS and required to be reengaged by occupants?

Steering ____ Braking ____ Acceleration ____ Other _____

6. SAEJ3016 8.3 provides that level 4 or 5 vehicles may have “an emergency stop lever”. Does this vehicle have this feature or its equivalent? Yes ____ No ____

How is the vehicle designed to allow the feature to be engaged?

How is the vehicle designed to limit or prohibit the feature to be engaged?

D. Did the occupant take control?

1. Is the vehicle designed **to allow** an occupant to voluntarily disengage **all** ADS driving control and assume manual control of driving operations? If so, how?
2. Is the vehicle designed to allow an occupant to voluntarily disengage **some but not all** ADS driving control and assume manual control of driving operations? If so, how?
3. Is the vehicle designed to **restrict** an occupant from voluntarily disengaging **all** ADS driving control and assuming manual control of driving operations? If so, how?
4. Is the vehicle designed to **restrict** an occupant from voluntarily disengaging **some but not all** ADS driving control and assuming manual control of driving operations? If so, how?
5. Is the vehicle designed to **prohibit** an occupant from voluntarily disengaging **all** ADS driving control and assuming manual control of driving operations? If so, how?
6. Is the vehicle designed to **prohibit** an occupant from voluntarily disengaging **some but not all** ADS driving control and assuming manual control of driving operations? If so, how?

D. Did the occupant take control?

7. Is the vehicle designed to prohibit any occupant control?

8. Is the vehicle designed to enable the ADS to take vehicle driving operations control from an occupant without the occupants' consent?

9. Is the vehicle designed for an occupant who has taken control of driving operations to then give vehicle driving operations control back to the ADS?

10. Is the vehicle designed so that all vehicle driving operations controls taken back by the occupant in compliance with the relevant FMVSS requirements?

E. Was the occupant required or notified to take control?

- 1. How is the vehicle designed to disengage all ADS driving control and require an occupant to assume manual control of driving operations?**
- 2. How is the vehicle designed to disengage some but not all ADS driving control and require an occupant to assume manual control of driving operations?**
- 3. How is the vehicle designed to inform the occupant of the driving operations for which the occupant has taken or been required to take control?**
- 4. How is the vehicle designed to verify that the occupants required to assume manual control of driving operations have any specific knowledge, ability and/or acceptance of that driving operation control responsibility?**
- 5. If there are multiple occupants in the vehicle, how is the vehicle designed to verify that any or all of the multiple occupants have/has the knowledge, ability and acceptance of driving operation control responsibility?**

E. Was the occupant required or notified to take control?

6. How is the vehicle designed to provide any information or instructions to occupants of driving operation control for which an occupant may be responsible?

7. How is the vehicle designed to verify occupants knowledge and/or ability for acceptance of driving operation control responsibility?

8. How is the vehicle designed for occupants accept driving operation control responsibility?

F. Was the occupant made aware of all operational domains and constraints ?

- 1. How is the vehicle designed to inform occupants of any and all occupant responsibilities?**
- 2. How is the vehicle designed to inform occupants as to what the ADS can do and what the ADS will not do, and under what conditions and limitations?**
- 3. How is the vehicle designed to inform occupants of any notifications or warnings that the occupants may be given during driving operations and what the notifications mean?**
- 4. How is the vehicle designed to require occupants to verify that that occupant understands and accepts the ADS information and/or notifications?**

G. Was it reasonable for the occupant to take control?

Voluntary Occupant Assumption of Control

- 1. Which controls of driving operations is the vehicle designed to allow the occupant to voluntarily engage or disengage from the ADS during driving operations?**
- 2. Which controls of driving operations is the vehicle designed to not allow the occupant to voluntarily engage or disengage from the ADS during driving operations?**
- 3. What preconditions – if any – is the vehicle designed to require for driving operations controls to be voluntarily engaged or disengaged by an occupant?**
- 4. Are there conditions in which the is the vehicle designed to will not allow the occupant to voluntarily assume control of driving operations?**
- 5. What actions is the vehicle designed to require from an occupant for which driving operation controls to be engaged or disengaged by an occupant?**
- 6. How much time is the vehicle designed to require to allow the occupant to voluntarily assume control of driving operations?**

G. Was it reasonable for the occupant to take control?

Vehicle Requires Occupant Assumption of Control

7. Under what conditions is the vehicle designed to require that an occupant to assume any control of driving operation controls?

8. If the ADS requires an occupant to assume control, how is the vehicle designed to notify an occupant of which driving operations controls to take over?

9. How much time after the occupant is alerted by the ADS for the occupant to assume control is the vehicle designed to require the occupant to assume control of driving operations?

10. How is the vehicle designed to determine/verify whether the occupant has assumed control of the driving operation?

11. What is the vehicle designed to do if the occupant does not assume control of the driving operation?

**H. Did the control that the operator assumed – or should have assumed
- (steering, braking, acceleration) cause or contribute to the crash?**

- 1. Which driving operation controls to be controlled exclusively by the ADS is the vehicle designed to record?**
- 2. Which driving operation controls to be controlled by a human driver exclusively is the vehicle designed to record?**
- 3. Is the vehicle designed to record when the human operator retained all driving operations from the beginning of the operation of the vehicle?**
- 4. Is the vehicle designed to record when the ADS retained all driving operations from the beginning of the operation of the vehicle?**
- 5. Is the vehicle designed to record when a human operator turned any or all driving operation control over to the ADS?**

H. Did the control that the operator assumed – or should have assumed - (steering, braking, acceleration) cause or contribute to the crash?

6. Is the vehicle designed to record when the ADS turned any or all driving operation control over to the human driver?

7. Is the vehicle designed to record when the ADS notified an occupant that the ADS was required to turn any or all driving operation control over to the human driver?

8. Is the vehicle designed to record when a human driver took over or attempted to take over driving operation controls from the ADS?

9. Is the vehicle designed to record controls of driving operations that the human operator was required or recommended to assume that the human operators did not assume?

for the
occupant to
take control?

I. Post-Sale ADS Upgrades

1. What is the process for informing owners of post-sale upgrades, obtaining their consent and providing the upgrades?
2. If the upgrade affects the safety of the vehicle, how is the owner so informed and what is the process if the owner does not consent to the upgrade?
3. Is there a record of upgrades offered and of upgrades accepted by the owner? Is this record accessible by the owner?
4. Is any of the data listed above recorded and available? Where, how, for what period and how is it accessible?

reasonable
for the
occupant to
take control?

NEXT STEPS ?

- **NAMIC AV Council Reps– Revise and validate the data sets**
- **IIHS/HLDI/Other Expert – commentary and revisions**
- **OEMs – Gauge interest/objections to providing data sets**
- **Define business solution to obtaining and using data sets**
- **Define remaining data sets and regulatory or legislative solutions**