



# Code of Practice for Automated Driving

ITS Virtual Congress 2020

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Fahrenkrog, BMW Group



# SP2 Overview.

## Overview.

- The objective of the SP2 is to develop a “Code of Practice for automated driving” (CoP-AD) focusing on the development of AD functions.
  - Collect best practices on relevant topics for developers.
  - Describe a typical process for the development of automated driving functions.
  - Include safety aspects and methods to confirm a safe operation of automated driving functions.
  - Include recommendations / guidelines for the development of these functions.
- The targeted user group includes engineers and other stakeholders in the field of automated driving.

GRUPE RENAULT



DAIMLER



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TOYOTA



Code of Practice

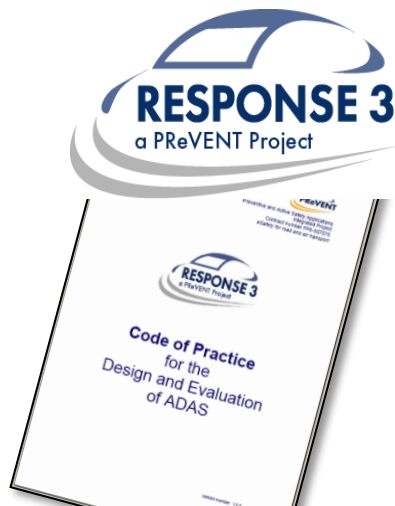
## SP2 Overview.

### History of the Code of Practice I

- The CoP activities started with the rise of ADAS - the potential of the function was identified, however technical limits as well as liability issues could delay the market introduction of ADAS.
- RESPONSE 1 project (1998 – 2001):
  - Proposal to create a Code of Practice for ADAS containing “principles” for the development and evaluation of ADAS should be established on a voluntary basis, as a result of a common agreement between all involved partners and stakeholders.
- RESPONSE 2 project (2002 – 2004):
  - The requirements for an ADAS Code of Practice were further elaborated
- RESPONSE 3 project (2004 – 2008) within PReVENT:
  - Final “Code of Practice for ADAS” (CoP) (Knapp et al. 2009).

# SP2 Overview.

## History of the Code of Practice II.



PREVENT:  
RESPONSE 3 „CoP ADAS“

2008 2014



Adapt!Ve:  
Response 4 „Legal aspects AD“

2017 2017



L3Pilot:  
„Code of Practice AD“

2021

# Code of Practice for Automated Driving. Building blocks.

- The CoP-AD is based on the current state of the art and best-practices.

## Scope

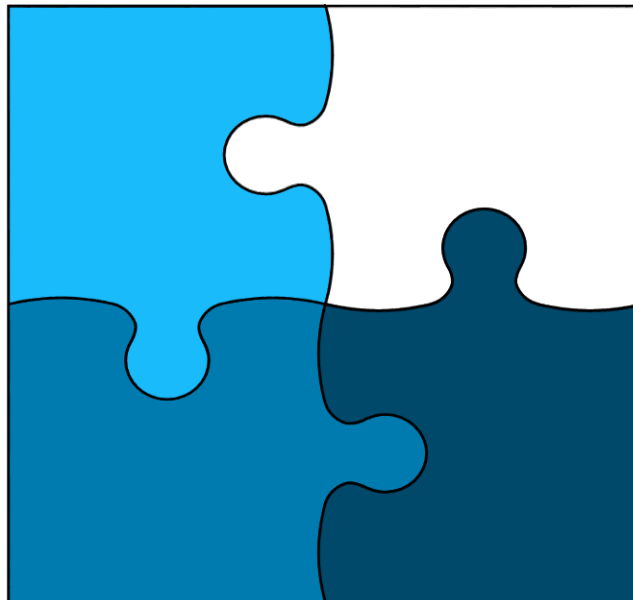
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Identify the topics that need to be covered by the CoP-AD in order to support a safe development.

## Acceptance

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The CoP-AD must be understandable and provide valuable information.



## Structure

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Due to its complexity of AD the topics need to be cluster according to the demans for development

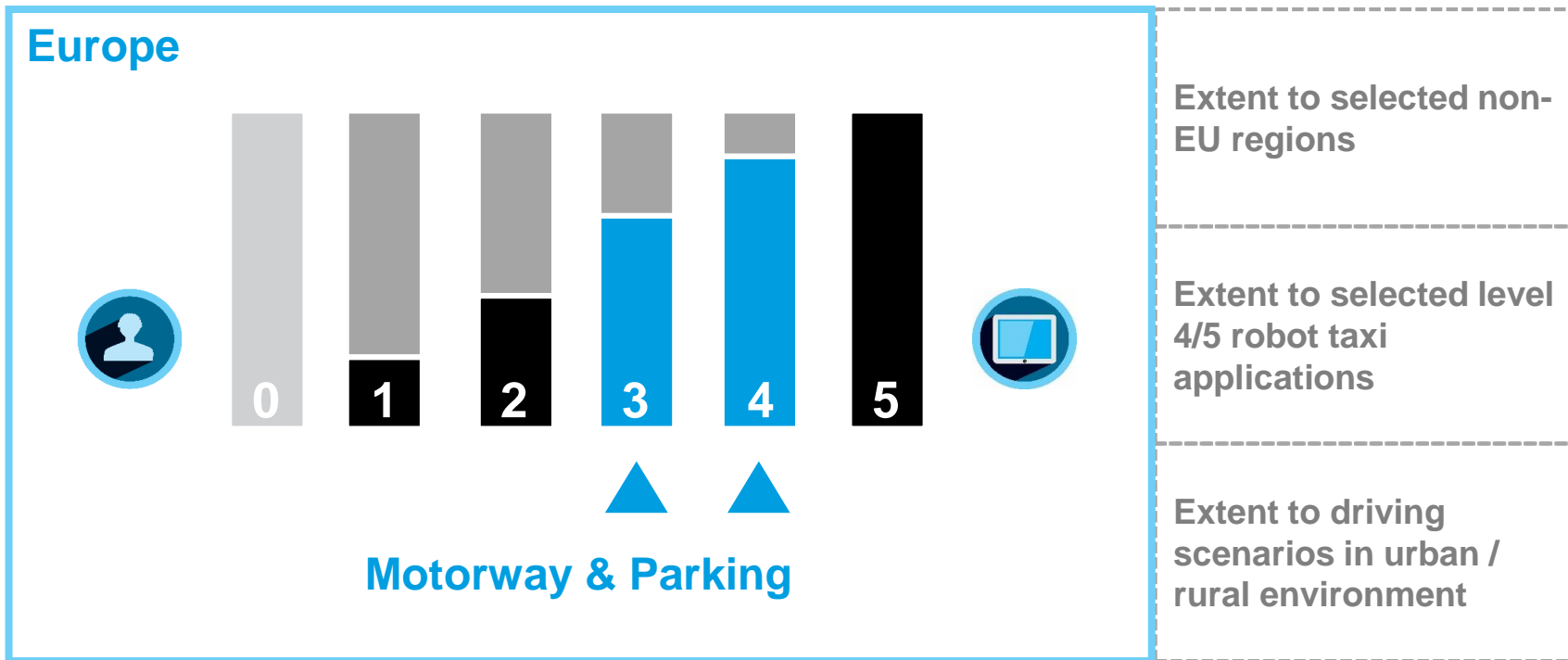
## Quality

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Several review process are required in order to ensure the required level of quality.

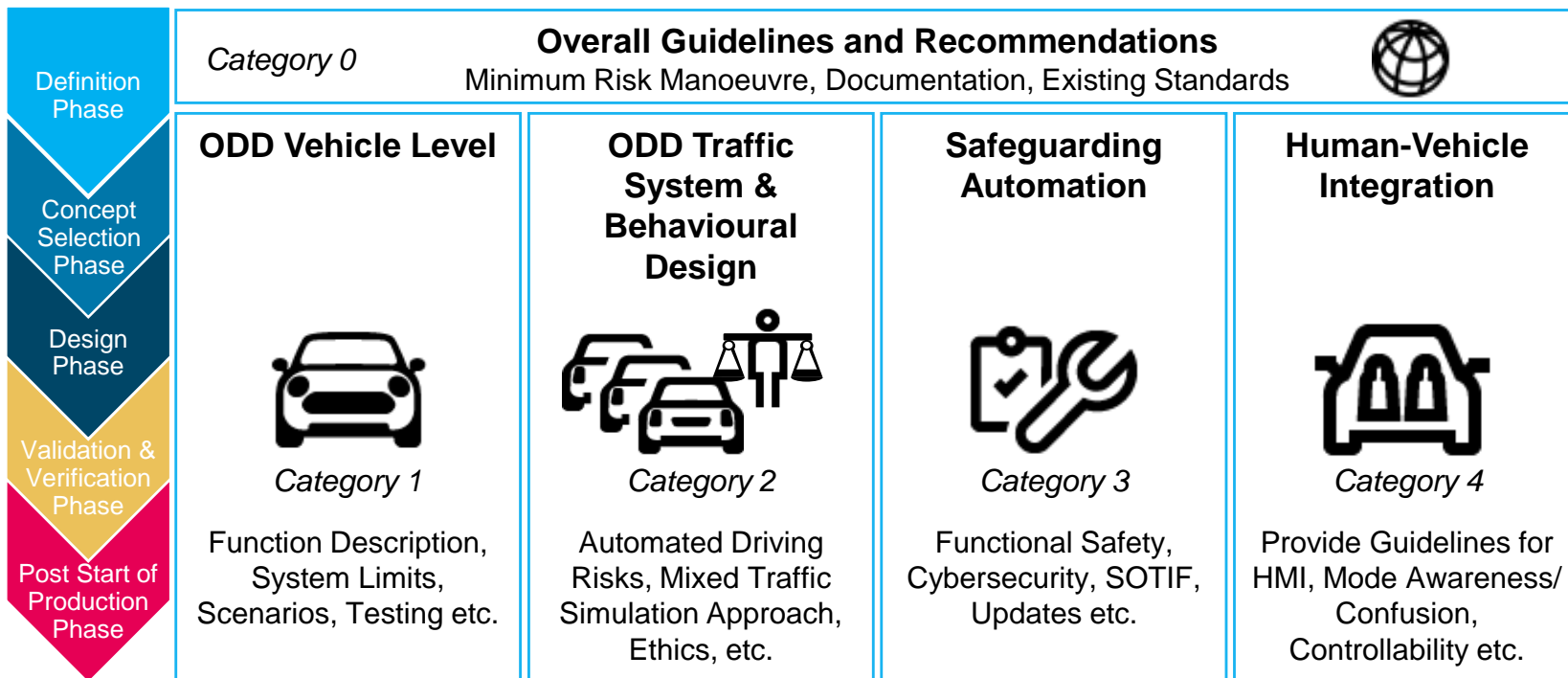
# Code of Practice for Automated Driving. Scope of the CoP-AD.

According to SAE document J3016, "Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles", revised 2016-09-30, see also [http://standards.sae.org/j3016\\_201609](http://standards.sae.org/j3016_201609)



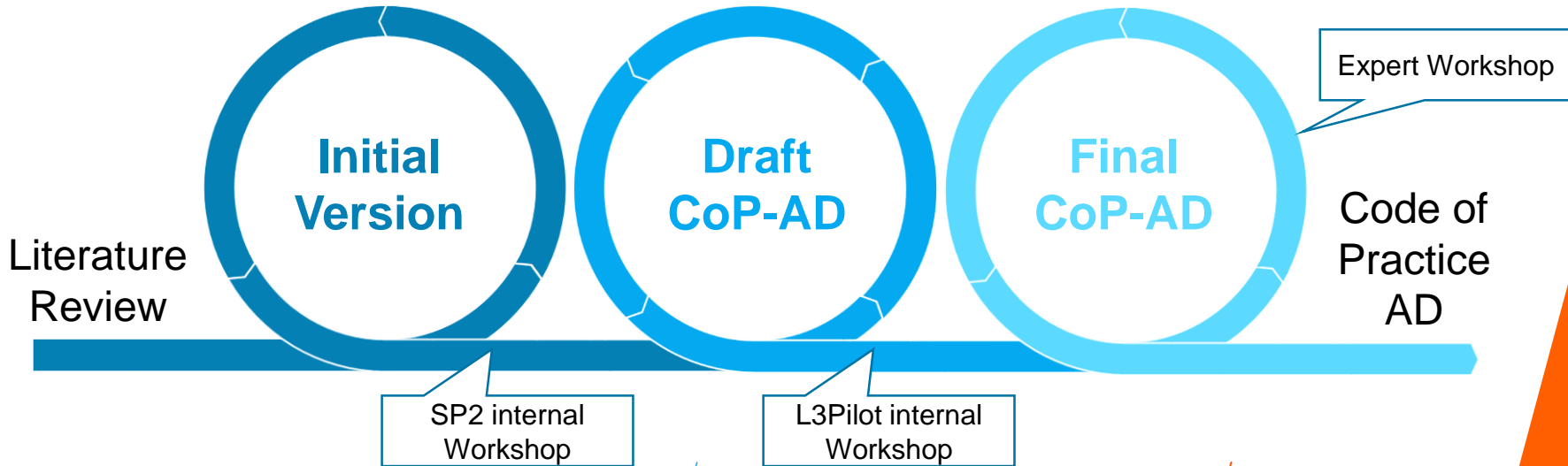
# Code of Practice for Automated Driving

## Categories of CoP-AD



# Code of Practice for Automated Driving. Process of developing.

- The CoP-AD is based on the current state of the art and best-practices.
- The development of the CoP-AD is iterative process considering regular reviews by stakeholders.

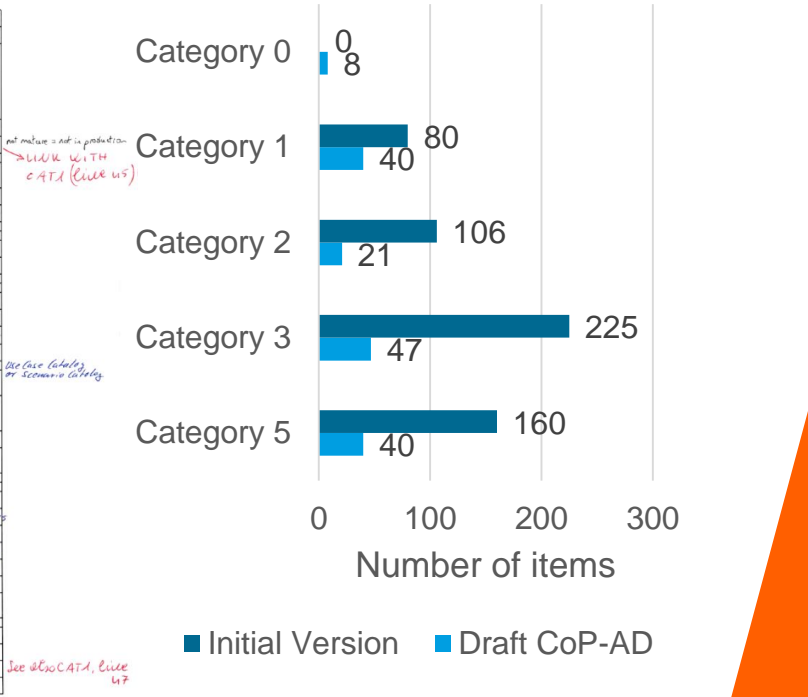




# Code of Practice for Automated Driving.

## Question Consolidation – SP internal Workshop.

Category	No.	Timing	Main Question for CoP	Comment	Correct Timing (Yes)	Correct Timing (No)	Main Question (Yes)	Main Question (No)
4.2	21	Concept selection & Proof of Concept	Is there an indication of a system inhibited minimum risk manoeuvre?	Needs to make final with NHTA based Feb 6 150 2982	✓			
1.3	15	Post start of Production Phase	Do you have a strategy to gather customer feedback and reflect it into future projects?	LINK WITH CATX (WORK IN PROGRESS) → Definition		Definition		
2.1	4	Definition Phase	4) Have you considered interaction with traffic and environment? Refer to the L3/H4 AD function description for details. Is the AD vehicle requesting traffic cues? Is the AD vehicle considering infrastructure cues? (eg. fog, bad road conditions such as holes, mud...)? If have you considered which risks may occur within the OOD? (at any possibility point)? Have you identified your system limitations within the OOD? Do they cause the identified/considered risks? Does your AD system operate part of the time or everywhere at all times? Have you considered possible risks during abandonment of OOD? Have you considered unpredictable or unsafe manoeuvres made by surrounding traffic?	Maybe duplication → too many questions → too many questions			✓	✓
1.1	21	Verification and Validation & Sign-off	Can you describe your approach for the training of safety drivers or remote operators?	NA - training manual (Driver specific) + training of CoP	Definition			
4.2	23	Concept selection & Proof of Concept	Is the driver aware of the system's maturity? (1)	Paper to use after terms release of matured (reg. in position) → Definition	✓			
3.5	83	Design phase	recording and, where necessary, reporting personal data breaches.	→ Definition				
1.6	30	From Design Phase to Proof of Concept	Have you assessed which driving licence is required to operate the test vehicle?	→ Proof phase? only valid remote level 2		✓		
1.1	4	Definition Phase	Have you considered the feasibility and the usage condition of the requirements (i.e. when and in which cases can the requirement be realised)?	→ which requires is marked ✓				
1.3	8	Proof of Concept Phase	Have you considered how to inform users when system/software update is done?	→ no option 3				
2.4	13	Definition Phase	Do you plan for user (active and passive usage) education/training on ADF?	→ no content of training STILL IN CATX, L1, L2, L3, L4	Definition			
3.5	120	Post SOP	Do we enable safe and secure software updates if system becomes concept?	for the delivery on the car, license or a customer?		X		X
4.6	14	Concept Selection & Proof of Concept	How does a test sample need to be stratified according to age, gender etc.?	→ no data to stratify → not stratified				
4.2	11	Concept selection & Proof of Concept	Is the number of different driving modes appropriate / too many?	→ no data to stratify → not stratified	✓			
2.1	12	Definition Phase	(1) Have you prioritised their interaction based on their frequency and severity?	→ no data to stratify → not stratified				
3.4	1	Definition phase	Do you derive SCIF assessments from hazard analysis?	→ no data to stratify → not stratified				
1.1	18	Concept Phase	Have you derived the OOD taxonomy of the ADF from the concept of the use cases?	→ no data to stratify → not stratified				
1.6	14	Design Phase	Do you have a process in place that stores / archives all relevant documents related to the test you plan to do or have done?	→ no data to stratify → not stratified				
4.6	1	Definition phase	Do you take into account people with disabilities? (1)	→ no data to stratify → not stratified				
3.5	20	Post SOP	Is the manual control point for the customer?	→ no data to stratify → not stratified				
3.5	87	Design phase	Do we have appropriate processes in place to comply with individuals' requests for access under the right to be forgotten?	→ no data to stratify → not stratified				
1.2	2	Concept Selection & Proof of Concept	Are they appropriate in the same situations/conditions?	→ no data to stratify → not stratified				
4.2	38	Validation & Sign-off	Do customers use the system appropriately?	→ no data to stratify → not stratified	✓		✓	
1.3	1	Definition Phase	Have you considered customer preferences and abilities of the ADF you are designing? Possible rephrase: have you considered the "voice of customer" and their abilities when designing your ADF?	→ no data to stratify → not stratified				
3.2	24	Post SOP	Have you considered whether any of the system security support will expire? i.e. have you properly informed the user?	→ no data to stratify → not stratified				
4.4	36	Verification, Validation & sign-off	Is there any still degradation due to the use of the automated driving function? (1)	→ no data to stratify → not stratified				
3.5	45	Design phase	Do we ensure the accuracy of any personal data we create?	→ no data to stratify → not stratified				
1.6	19	All Phases	Do you have arranged the right interfaces to connect the ADF to the test tool?	→ no data to stratify → not stratified				
4.1	20	Concept Selection & Proof of Concept	How do you consider to communicate system states in accordance with common conditions and stereotypes? (1)	→ no data to stratify → not stratified				
2.1	3	Definition Phase	(1) Do you consider to comply with the national traffic laws? Does the use name of the ADF define clearly its capabilities?	→ no data to stratify → not stratified				
4.1	28	Concept Selection & Proof of Concept	How do you consider to comply with the national traffic laws? Does the use name of the ADF define clearly its capabilities?	→ no data to stratify → not stratified				
4.2	20	Concept Selection & Proof of Concept	How do you consider to comply with the national traffic laws? Does the use name of the ADF define clearly its capabilities?	→ no data to stratify → not stratified				
3.1	7	Design phase	Have you specified different operation modes and safe states in presence of a fault (depending on the level of fault)?	→ no data to stratify → not stratified				
4.1	24	Concept selection & Proof of Concept	Do you present high priority messages in a multimodal way? (1)	→ no data to stratify → not stratified				
3.2	20	R & V	Have you considered other means of testing such as functional security testing to assess security functions, fuzz testing for code, or regression testing containing hardware & software?	→ no data to stratify → not stratified				
3.8	21	Design phase	Do we give the customer the choice to share or not share data where possible?	→ no data to stratify → not stratified				
4.2	14	Concept Selection & Proof of Concept	Is it clear mirroring is possible, will the content be reported according to the mirroring mode?	→ no data to stratify → not stratified				
4.1	28	Concept Selection & Proof of Concept	How is the concept evaluated with regard to UX and Usability Guidelines (e.g. dialogue design) in customer clinics with test subjects? (1,2)	→ no data to stratify → not stratified				
4.4	11	Concept Selection & Proof of Concept	Is the driver informed of a detectable system malfunction occurs? (3)	→ no data to stratify → not stratified				
4.3	11	Concept Selection & Proof of Concept	Is there a possibility to add additional supplementary data to the vehicle HMI in the future?	→ no data to stratify → not stratified				



# Code of Practice for Automated Driving. Draft CoP-AD – Question Card.

- Example: Category X - Topic Y – Number of Question



Question X-Y-Z	Relevant Phase(s)	DF	CO	DS	VV	PS
Main question? ( ) Yes / ( ) No						
				<ul style="list-style-type: none"> <li>• Sub-Question 1</li> <li>• Sub-Question 2</li> <li>• Sub-Question 3</li> </ul>		

- Followed by text explaining the question and providing additional references.

# Code of Practice for Automated Driving. How to use the CoP AD?

- Implementation of CoP AD is up to the companies:
  - Address the question directly in a dedicated process
  - Include the questions in already existing development processes
- Focus is not on solutions how to handle issues, but on things not to forget when developing automated driving functions
- Relevant questions shall be addressed according to the development phases
- Application might be eased using tools based on CoP AD document

Question-0-3-1	Relevant-Phase(s)	DF	CO	DS	VV	PS
Are (industry) standards and best practices according to their current availability been followed?						
(...)-Yes / (...)-No						

Question-4-2-9	Relevant-Phase(s)		CO	DS	VV	
Is the communication to the driver, of the driver's responsibilities in each defined automated driving mode(s) investigated and confirmed?						
(...)-Yes / (...)-No						

## Conclusion

- The subproject 2 continues the tradition of developing a Code of Practice.
- Analogue the Response 3 Code of Practice which focuses on ADAS, the CoP-AD will focus on the guidelines & recommendation for the development of automated driving.
- An iterative process has been chosen for developing the CoP-AD.
- Draft CoP-AD is available on the L3Pilot website: <https://bit.ly/3nrJHfm>.
- The final version of the CoP-AD will be available in 2021.



Thank you for your kind attention.

**Felix Fahrenkrog, BMW**



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