

Identified Gaps in the Provisions of the UN Regulation No. [157] (ALKS) (ECE/TRANS/WP.29/2020/81)

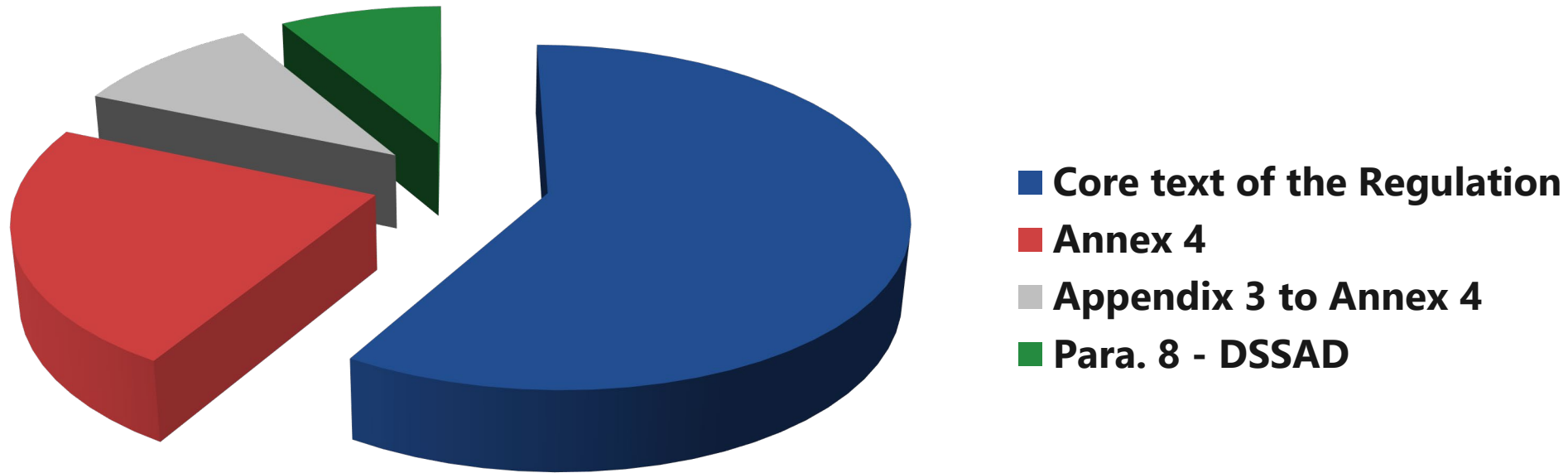
From the Approval Authority Standpoint

Note: This document is distributed as a background for the proposal
for a Supplement to UN Regulation No. [157] (ALKS) for information only.

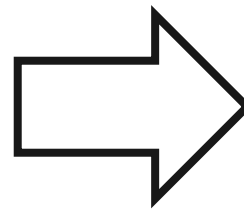
Why the concerns are raised now?

- The full text of ALKS UN Regulation was combined just at the 6th GRVA session in March 2020.
- Each part of ALKS UN Regulation is correct.
The concerns appear when the parts are brought together.

The regulatory text was combined from the parts prepared by the different drafting groups



- Missed links between regulatory parts
- Inconsistency in regulatory provisions



Inconsistency of an approach to compliance assessment by different Approval Authorities

Definitions

Para. 2.1.

- "Automated Lane Keeping System (ALKS)" for low speed application is a system which is activated by the driver and which keeps the vehicle within its lane for travelling speed of 60 km/h or less by controlling the lateral and longitudinal movements of the vehicle for extended periods without the need for further driver input.
- Within this Regulation, ALKS is also referred to as "*the system*".

Annex 4, Para. 2.1.

- "*The system*" means a "*Higher-Level Electronic Control*" system and its electronic control system(s) that provide the automated driving function. This also includes any transmission links to or from other systems that are outside the scope of this Regulation that act_s on the automated lane keeping function.

Are the same systems meant? – [Seems "Yes"]

Proposal: Annex 4, Para. 2.1.: "The system" shall mean "ALKS"

Definitions – Comments Received

Para 2.1

- In our understanding we are talking about two different „kind“ of systems:
 1. in core text: “system” is used more generally as term to describe the driving function (which controls the lateral and longitudinal movement of the vehicle)
 2. in Annex 4: “system” purely has a “technical/electrical” meaning→ „system“ in core text translates into „automated driving function“ in Annex 4
 - AL: This is the same system in my view (but including the link with other systems). This is a major change compared to old Annex 6 to R79
 - FR : from our point of view, both definitions are compatible and consistent.
- Within this Regulation, ALKS is also automated lane keeping function. referred to as *“the system”*.

Are the same systems meant? – [Seems “Yes”]

Proposal: Annex 4, Para. 2.1.: “The system” shall mean “ALKS”

References to Annex 4 in the core text do not match with Annex 4

“The fulfilment of the provisions of this paragraph shall be demonstrated by the manufacturer to the technical service during the inspection of the safety approach as part of the assessment to Annex 4”.

- 5.1. General Requirements
- 5.2. Dynamic Driving Task + 5.2.4., 5.2.5., 5.2.5.4.
- 5.3. Emergency Manoeuvre (EM)
- 5.4. Transition demand + 5.4.1.
- 5.5. Minimum Risk Manoeuvre (MRM)
- 6.1. Driver Availability Recognition System + 6.1.3.1.
- 6.2. Activation, Deactivation and Driver Input + 6.2.5.4.
- 6.3. System override: 6.3.1., 6.3.1.1., 6.3.7.
- 6.4. Information to the driver: 6.4.4.
- 7.1. OEDR Sensing requirements + 7.1.3., 7.1.6.
- 8.1. DSSAD

Annex 4:

No case from the left column is mentioned, although verification of HMI and OEDR is mentioned (paras. 4.1.2. & 4.1.2.1.)

Proposal:

Clearly list in Annex 4, which items to be verified.

References to Annex 4 in the core text do not match with Annex 4

- Comments Received

"The fulfilment of the provisions of this paragraph shall be demonstrated by the manufacturer to the technical service during the inspection of the safety approach as part of the assessment to Annex 4".

- 5.1. General Requirements
- 5.2. Dynamic Driving Task + 5.2.4., 5.2.5., 5.2.5.4.
- 5.3. Emergency Manoeuvre (EM)
- 5.4. Transition demand + 5.4.1.
- 5.5. Minimum Risk Manoeuvre (MRM)
- 6.1. Driver Availability Recognition System + 6.1.3.1.
- 6.2. Activation, Deactivation
- 6.3. System overriding
- 6.4. Information to the driver
- 7.1. OEDR Sensing
- 8.1. DSSAD

Annex 4:

No case from the left column is mentioned, although verification of HMI and OEDR is mentioned (paras. 4.1.2. & 4.1.2.1.)

Proposal:

Clearly list in Annex 4, which items to be verified.

Definitely agree in principle that consistency needs to be established (and at the same time avoid unnecessary duplications)

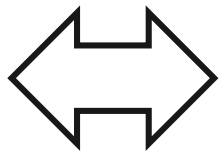
⇒ AL: In my view the cross reference from the core text to Annex 4 is sufficient+ para 3,1, (b) of Annex 4. So no need to make reference from the Annex to the core text again. HMI and OEDR were last minute comments in VMAD. I will double if they are needed

→ FR : from our point of view, consistency is preserved by the mention in all core text paragraphs.

Gaps in Annex 4 (Verification of functional and operational safety aspects) (1)

Header:

Special requirements to be applied to the functional and operational safety aspects of Automated Lane Keeping Systems (ALKS)



Actually:

Requirements to the documentation provided for the audit of the functional and operational safety aspects of Automated Lane Keeping Systems (ALKS)

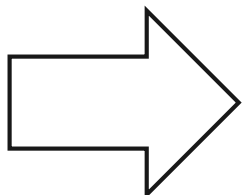
Assumptions:

The audit is understood as verification of manufacturers' **documentation** demonstrating to the Approval Authority the functional and operational safety aspects of ALKS including the results of the simulation, test-track, and real-world testing.

The Approval Authority / Technical Service just reviews and analyses the manufacturer's documentation. It should not carry out simulation or tests according to this Annex as the tests are the subject of Annex 5 unless otherwise will follow from the implementation of Appendix 3 to Annex 4, which is presently not clear.

Content:

4. Verification and tests



Content:

4. Verification [of manufacturers' documentation] and tests  **Subject of Annex 5**

Gaps in Annex 4 (Verification of functional and operational safety aspects) (1)

- Comments Received

Header:

Actually:

Can confirm this is also our current understanding.

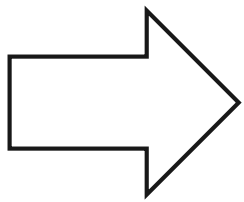
(Although generally, in the future, simulation could also be part of type approval assessment, meaning simulations are conducted by the Approval Authority or Technical Service)

→ AL: The audit cannot only be paper based, but has to include physical verification (like today in Annex 6 of R79). Of course we shall take into account tests carried out under Annex 5 (which can be used as part of the verification of the audit), but authorities may for instance ask the manufacturer to test a vehicle outside the conditions defined in Annex 5. In my view simulation from the manufacturer can be used to confirm the findings of the audit as well (but cannot replace the test in Annex 5)

→ FR : Annex 4 is in a first step based on an OEM documentation/justification analysis. Depending on the results of this analysis, TAA/TSA may require tests in order to check specific points discussed during the audit evaluation. These tests can be based on scenarios listed in annex 5 with specific test parameters (annex 5 opened in this way) or/and on additional scenarios not covered by annex 5. All tests from annex 5 have to be finally performed during approval process, requested following annex 4 audit or not.

Content:

4. Verification and tests



Content:

4. Verification [of manufacturers' documentation] and tests → Subject of Annex 5



Gaps in Annex 4 (Verification of functional and operational safety aspects) (2)

Content:

6. Communication to other Type Approval Authorities (Appendix 2) containing...

Para. 3.4.4.:

The 3rd subparagraph: "The Type Approval Authority shall perform an assessment..."

The last subparagraph: "The Type Approval Authority shall perform or shall require performing tests as specified in paragraph 4. to verify the safety concept".

What does that mean?

Appendix 2 is the form of the Information document form for automated lane keeping systems to be provided by the manufacturer for the approval

Para. 6 has to be revisited

Para. 3.4.4. from the 3rd subparagraph should be moved to Section 4.

The last subparagraph: "The Type Approval Authority shall perform or shall require performing tests as specified in **Annex 5** to verify the safety concept".

Plus:

["The Type Approval Authority shall perform or shall require performing **simulation** as specified in **Appendix 3 to this Annex** to verify the safety concept".]

Gaps in Annex 4 (Verification of functional and operational safety aspects) (2)

- Comments Received

Content:

6. Communication to other Type Approval Authorities (Appendix 2) containing...

Para. 3.4.4.:

The 3rd subparagraph: "The Type Approval Assessment"

The last subparagraph: "The Type Approval Assessment shall require performing specified tests to verify the safety"

What does that mean?
Appendix 2 is the form of the Information document form for automated lane keeping systems to be provided by the manufacturer for the approval

Para. 6 has to be revisited
Para. 3.4.4. from the 3rd subparagraph should be moved to Section 4.

DE: Appendix 2 (of Annex 4) is part of the Communication form (Annex 1) and gives more detailed information about ALKS.

⇒ AL: Check ECE/TRANS/WP29/2020/81. What is communicated to other authorities is an extract of Appendix2 (high level description)

⇒ 3.4.4. are documentary check on the safety argumentations. Para 4 are physical/simulation tests to confirm the documentation. Some physical checks are mandatory in Annex 5. Simulation is not mandatory, but can be used (not as an alternative to physical test in Annex 5)

→ FR : we agree that the word "other" in § 6. shall be removed, bringing confusion and support EC positions on understanding of § 3.4.4.

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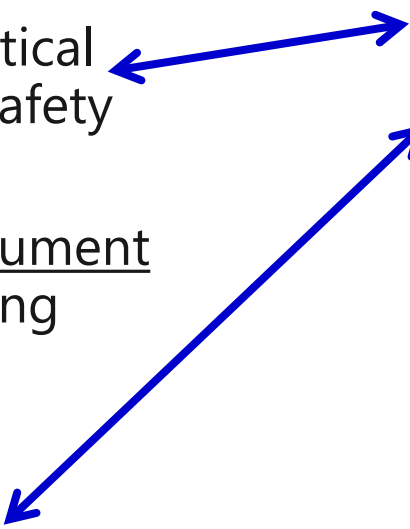
Gaps in Annex 4 (Verification of functional and operational safety aspects) (3)

Para. 4.2.:

"Simulation tool and mathematical models for verification of the safety concept..."

Appendix 2 - Information document form for automated lane keeping systems to be provided by the manufacturer for the approval:

"7. Verification and test by the authorities..."



In para. 4.2., could be a reference to Appendix 3.

Section 7 is not logic as Appendix 2 is the form of the Information document for ALKS to be provided by a manufacturer before the approval process.

Note: If the communication from the Approval Authority to other Approval Authorities is needed, there should be a template for that communication and the list of items to be communicated.

In Annex 4, there is no reference to Appendix 3, but this reference should be.
In Annex 4, there should be a reference to Annex 5.

Treatment of Appendix 3 to Annex 4 (Guidance on Traffic disturbance critical scenarios for ALKS) (1)

Just one reference in the core text:

Para. 5.2.5.:

"For conditions not specified in paragraphs 5.2.4., 5.2.5. or its subparagraphs, this shall be ensured at least to the level at which a competent and careful human driver could minimize the risks. This shall be demonstrated in the assessment carried out under Annex 4 and by taking guidance from Appendix 3 to Annex 4."

The reference to Appendix 3 in the core text is undesirable. The reference should be made in Annex 4. In para. 4.2. of Annex 4, could be a reference to Appendix 3.

Para. 5.2.5. amend to read:

"...This shall be demonstrated in the assessment carried out under Annex 4 and by taking guidance from Appendix 3 to Annex 4."

Treatment of Appendix 3 to Annex 4 (Guidance on Traffic disturbance critical scenarios for ALKS) (1)

- Comments Received

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The reference to Appendix 3 in the core text is undesirable. The reference should be made in Annex 4. In para. 4.2. of Annex 4, could be a reference to Appendix 3.

Para. 5.2.5. amend to read:

"...This shall be demonstrated in the assessment carried out under Annex 4 and by taking guidance from Appendix 3 to Annex 4."

DE: We now share your understanding and can therefore agree to your proposal.

Actually, to explain our reading before: we thought this aspect you now add ("*this shall be demonstrated in the assessment carried out under Annex 4*") was already "covered" by para. 5.1 -- even though now that you point it out, you are for sure right, the intention in para. 5.2.5. should not be to limit an assessment to Appendix 3 only.

→ Therefore we can support your amendment.

JPN: Appendix 3 is the validation method of the requirement in paragraph

5.2.5 (the level at which a competent and careful human driver could minimize the risks) and in order to clearly show the linkage between the requirement and its validation method, the appendix should be directly linked to the same paragraph as the requirement. The importance of clearly indicating the relationship between them by putting in the same paragraph the requirement and the link to the corresponding appendix was first proposed by the chair of GRVA and supported by EC at the 5th GRVA, and the text was drafted accordingly and agreed at the 6th GRVA. → Therefore we do not support your suggested amendment.

EC: the idea with Appendix 3 was to define the critical scenarios in the most comprehensive manner. This fits better with the core text, (5.2.5)

Treatment of Appendix 3 to Annex 4 (Guidance on Traffic disturbance critical scenarios for ALKS) (2)

Questions raised to Appendix 3, which could be clarified in the regulatory text:

- Is this an option for simulation?
- Is this an example of simulation?
- Are the three presented scenarios mandatory for simulation?
- What is the objective of the simulation – to make sure that no accident shall happen in the green field of the pictures?
- Who shall perform the simulation:
 - A manufacturer?
 - An Approval Authority / Technical service?
- Where to find the software for such a simulation? – If this simulation is mandatory, for the uniformity, the software should be available.
- How to assess the simulation results if different parameters / simulation models were implemented? – The conditions of Schedule 8 to the 1958 Agreement shall apply.
- **In general, why this Appendix is needed?** – The ALKS UN Regulation is self-sufficient without Appendix 3.

Treatment of Appendix 3 to Annex 4 (Guidance on Traffic disturbance critical scenarios for ALKS) (2)

- Comments Received

Questions raised to Appendix 3, w

- Is this an option for simulation?
- Is this an example of simulation?
- Are the three presented scenarios
- What is the objective of the simulation? When shall an accident shall happen in the green field?
- Who shall perform the simulation:
 - A manufacturer?
 - An Approval Authority / Technical Service?
- Where to find the software for such simulation? Is it mandatory, for the uniformity, the same software?
- How to assess the simulation results? Do the simulation models were implemented to the 1958 Agreement shall apply?
- **In general, why this Appendix is necessary?** If the UN Regulation is self-sufficient with

DE: We understand your questions and hope our colleagues from Japan can help with explanations to clarify! ☺

Generally, in our view any Annex or Appendix – and this Appendix in particular since it introduces a new model – should:

- enable other CPs to add/contribute with own national data
- be transparent in how the models are valid for other (national) traffic conditions and can be transferred/applied to them
- give/enable “flexibility” to evolve as the automated driving systems will develop over time as well

JPN: First of all, we would like to point out that Appendix3 is describing scenarios which was considered in SG1a whereas simulation was considered in SG2a and is provided in Annex4.

Generally speaking, Appendix3 provides sufficient coverage of patterns of scenarios under which ALKS shall not cause any collision, which have not been realized by the previous approach. These concepts are considered based on "reasonably foreseeable" and "reasonably preventable" principle provided in the Framework Document. Without Appendix3, the boundary of scenarios under which collisions should be prevented and under which collisions can be regarded as unpreventable is ambiguous (please see GRVA-05-62e).

Since Appendix3 is a guidance in this regulation, it is not mandatory from the regulatory point of view but SG1a thinks that at least three types of many scenarios are necessary for the assessment of ALKS.

As for the questions regarding simulation, although SG2a may be in a better position to answer those questions, our understanding is that technical services can (not "shall") use Appendix 3 when assessing ALKS by doing multi-pillars including simulation, that the technical services shall ensure through such assessment that no collision is caused in the green field of the pictures, and that it is important to have a flexibility what the technical services should do (therefore, Annex 4 doesn't specify who perform what kind of tests and simulation. According to Annex 4, those should be decided by technical services and if so required by them, manufactures have to prepare simulation software.

Treatment of Appendix 3 to Annex 4 (Guidance on Traffic disturbance critical scenarios for ALKS) (3)

Possible solution to justify the need for Appendix 3:

Annex 4, add paragraph 4.2.1. to read:

“4.2.1. ALKS shall avoid a collision in following three traffic critical scenarios: lane change of another vehicle into the lane (cut-in), stationary obstacle after lane change of the lead vehicle (cut-out), and deceleration following a lead vehicle (deceleration), acting similarly to or better than an attentive human driver. This shall be demonstrated by a manufacturer by the means of simulation taking guidance from Appendix 3. The verification of the simulation results shall be provided by a manufacturer by the relevant physical test results performed in accordance with the provisions of paragraphs 4.4., 4.5., and 4.3. of Annex 5 for the listed scenarios respectively”.

Note: Same names shall be used for the same scenarios in Appendix 3 to Annex 4 and Annex 5.

Treatment of Appendix 3 to Annex 4 (Guidance on Traffic disturbance critical scenarios for ALKS) (3) -Comments Received

Possible solution to justify the need for Appendix

Annex 4, add paragraph 4.2.1. to read:

"4.2.1. ALKS shall avoid a collision in following three scenarios: lane change of another vehicle into the lane of the stationary obstacle after lane change of the lead vehicle and deceleration following a lead vehicle (deceleration) similarly to or better than an attentive human driver.

demonstrated by a manufacturer by the means of simulation taking guidance from Appendix 3. The verification of the simulation results shall be provided by a manufacturer by the relevant physical test results performed in accordance with the provisions of paragraphs 4.4., 4.5., and 4.3. of Annex 5 for the listed scenarios respectively".

Note: Same names shall be used for the same scenarios in Appendix 3 to Annex 4 and Annex 5.

DE: Understood what you are aiming at, but we should be careful that an amendment in Annex 4 does not read like a requirement itself.

JPN: The conclusion of the discussion of ALKS is not writing this kind of text and considers Appendix3 as a guidance.

EC: Is this not already covered by the core text (5.2.5)?

Gaps in Annex 5 (Test Specifications for ALKS)

Para. 1.:

"...the Technical Service shall ensure that the ALKS is subject to at least the tests outlined in Annex 5".

Para. 5.2.:

"Compliance with the following provisions shall be demonstrated by the manufacturer and assessed by the Technical Service at the time of type approval".

Who performs the tests:

- (a) Does the manufacturer perform tests and Approval Authority / Technical Service witnesses?
- (b) The manufacturer performed tests before and submits to the Approval Authority / Technical Service evidence documents to be audited as per Annex 4?
- (c) Approval Authority / Technical Service?

Proposal:

There should be a provision / recommendation:

- which tests have to be performed by a Technical Service;
- which tests have to be witnessed by an Approval Authority / Technical Service;
- which tests to be performed by a manufacturer with providing evidence documentation.

Gaps in Annex 5 (Test Specifications for ALKS) – Comments Received

Para. 1.:

"...the Technical Service shall ensure that the ALKS is subject to at least the tests outlined in Annex 5".

Para. 5.2.:

"Compliance with provisions shall be the manufacturer's responsibility Technical Service approval".

Who performs the tests:

- (a) Does the manufacturer perform tests and Approval Authority / Technical Service witnesses?
- (b) The manufacturer performed tests before and submits to the Approval Authority / Technical

DE: Our understanding is that all tests in Annex 5 are conducted by a Technical Service themselves (not just witnessed).

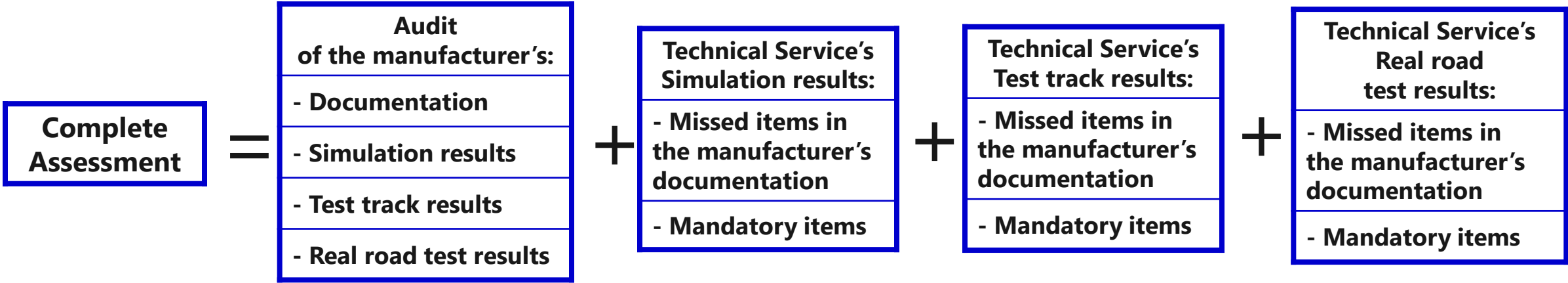
EC: This is also our understanding/ But I agree that this section is misleading and we need to discuss how it interact with Annex 4

→ FR : it was also our initial understanding but could be more clearly specified especially since annex 4 mention that TAA shall perform or require performing ...

- which tests to be performed by a manufacturer with providing evidence documentation.

Conclusive Remark

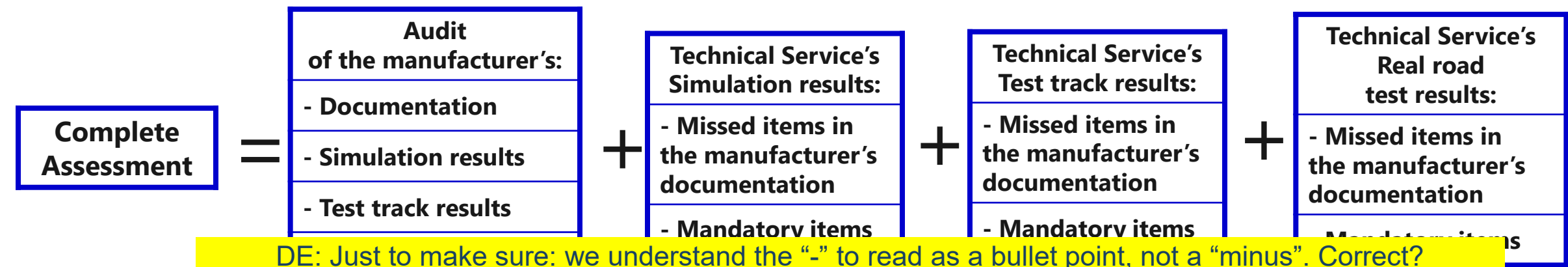
An Approval Authority has to have a complete picture of compliance assessment:



It would be nice to identify the mandatory items (if any) for verification by a Technical Service or, at least, give guidance for selection of such mandatory items.

Conclusive Remark – Comments Received

An Approval Authority has to have a complete picture of compliance assessment:



DE: Just to make sure: we understand the “-” to read as a bullet point, not a “minus”. Correct?
Yes, this summary seems to give the full picture. We are just wondering about the “Technical Service’s Simulation results”: where is this required in the ALKS Regulation? (Are we missing something...?) Isn’t simulation just part of the audit?

EC: I agree with Russia. We should define which items should be tested as a minimum. This requires more discussion

→ FR : this scheme is really understandable by TAA/TS, could be added in the Regulation ? Just some comments :

- Box 1 : simulation is not mandatory but optional
- Box 2 : not a dedicated box but an evaluation under box 1 if simulations are provided

It would be
by a Technic

- To issue a Supplement to the original text of the ALKS UN Regulation addressing the raised concerns.



Thank you for your attention!