Best Practices Implementing CoC and Type Approval Data Exchange for Vehicle Manufacturers

Smart IT Solutions for Manufacturers

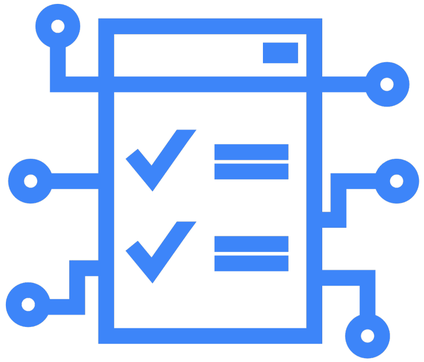
Agenda

- **Chances for the future:** Benefitting from digitalization
- **A paradigm shift:** Impacts of a digitalized homologation on vehicle manufacturers
- **Recommendations** from implementing the electronic CoC

Chances for the future

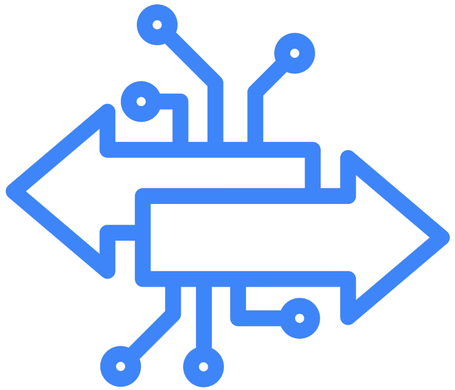
How manufacturers will benefit from a digitalized homologation

Homologation processes will have to be digitalized



digital documents

require



digital processes

Digitalized processes bring major improvements

Improved quality through
less errors

Quicker processes through
less manual work

Higher customer satisfaction
through seamless delivery

A Paradigm Shift

Moving from paper towards digital data

Human reader vs. Machine reader

Human reader

- Information needs to be accessible for the eyes
- If things are unclear, there is room to explain (footnotes, additional comments)
- Rather slow

→ Best served by a human writer

Human reader vs. Machine reader

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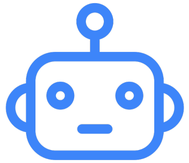

Machine reader

- Information needs a strictly defined structure
- Does not allow compromises on structure or data format
- Very fast

→ Best served by a machine writer

Paper thoughts

Masses

4.1.1.1.	Unladen mass(es) in running order	
4.1.1.1.1.	Maximum:	**2900** kg
4.1.1.1.2.	Minimum:	**2500** kg
4.1.2.1.	Technical permissible maximum laden mass(es):	**6000** kg
4.1.2.1.1.	Technical permissible maximum laden mass(es) per axle:	
	Axle 1:	**2700** kg
	Axle 2:	**3300** kg
4.1.2.2.	Mass(es) and tyre(s)	

Tyre combination No	Axle No	Tyre dimension incl load capacity index & speed category symbol	Rolling radius [mm]	Tyre Load rating per tyre [kg]	Maximum permissible mass per axle [kg]	Maximum permissible mass of vehicle [kg]	Maximum permissible vertical load on the coupling point [kg]	Track width [mm]	
								Minimum	Maximum
1	**1**	**235/65 R16C 121 R**	**356**	**1667**	**2700**	**6000**	**300**	**1048**	**1048**
	2	**235/65 R16C 111 R**	**356**	**1667**	**3300**			**83**	**83**
2	**1**	**235/65 R16C 121/128 R**	**356**	**1667**	**2700**	**6000**	**300**	**1048**	**1048**
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Maximum vertical load on the coupling per tyre combination depending on the coupling

Tyre combination number	E1-55R-12345	E1-55R-98765	E1-55R-98766	E1-55R-98767	E1-55R-98768
1	**5000** kg	**4000** kg	**5500** kg	**4400** kg	**5000** kg
2	**5000** kg	**5000** kg	- kg	- kg	- kg

Tyre combination number	E1-55R-98769
1	**4000** kg
2	- kg

4.1.2.3. Mass(es) and crawler undercarriage

Set of track trains No	Track dimensions		Average contact pressure on the ground [kPa]	Maximum load per track roller [kg]	Maximum permissible mass per set of track trains [kg]	Maximum permissible mass of the vehicle [kg]	Maximum permissible vertical load on the coupling point [kg]
	length [mm]	width [mm]					
-	-	-	-	-	-	-	-
	-	-	-	-	-		

4.1.3. Technically permissible towable mass(es) for each chassis/braking configuration of the R- or S-category vehicle:

Brake \ R- and S-category vehicle	Drawbar	Rigid drawbar	Centre-axle
Unbraked	**750** kg	**750** kg	**750** kg
Inertia-braked	**3000** kg	**3000** kg	**3000** kg
Hydraulic braked	- kg	- kg	- kg
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Brake \ R- and S-category vehicle	Drawbar	Rigid drawbar	Centre-axle
Unbraked	**4250** kg	**4250** kg	**4250** kg
Inertia-braked	**6500** kg	**6500** kg	**6500** kg
Hydraulic braked	- kg	- kg	- kg
Pneumatic braked	- kg	- kg	- kg

Ballast masses

29.2.	Number of sets of ballast masses:	-
29.2.1.	Number of components on each set:	
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	Set 2:	**10**
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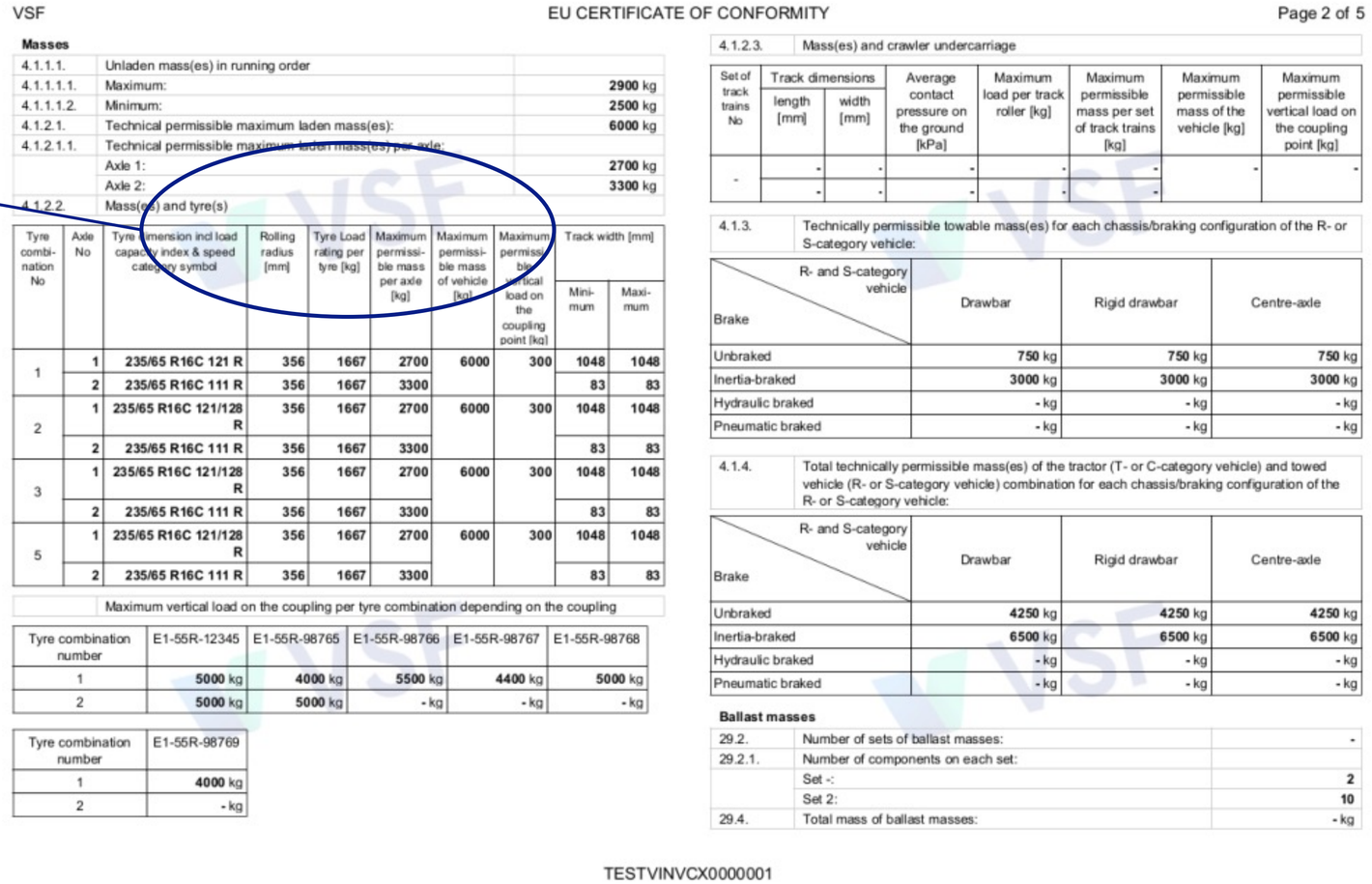
Paper thoughts

Needs corporate design



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2	**5000** kg	**5000** kg	- kg	- kg	- kg

Tyre combination number	E1-55R-98769
1	**4000** kg
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4.1.2.3. Mass(es) and crawler undercarriage

Set of track trains No	Track dimensions: length [mm]	Track dimensions: width [mm]	Average contact pressure on the ground [kPa]	Maximum load per track roller [kg]	Maximum permissible mass per set of track trains [kg]	Maximum permissible mass of the vehicle [kg]	Maximum permissible vertical load on the coupling point [kg]
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Ballast masses

29.2.	Number of sets of ballast masses:	-
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	Set -:	**2**
	Set 2:	**10**
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Paper thoughts

Needs corporate design

How to fit on one A4?

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Page 2 of 5

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2	**5000** kg	**5000** kg	- kg	- kg	- kg

Tyre combination number	E1-55R-98769
1	**4000** kg
2	- kg

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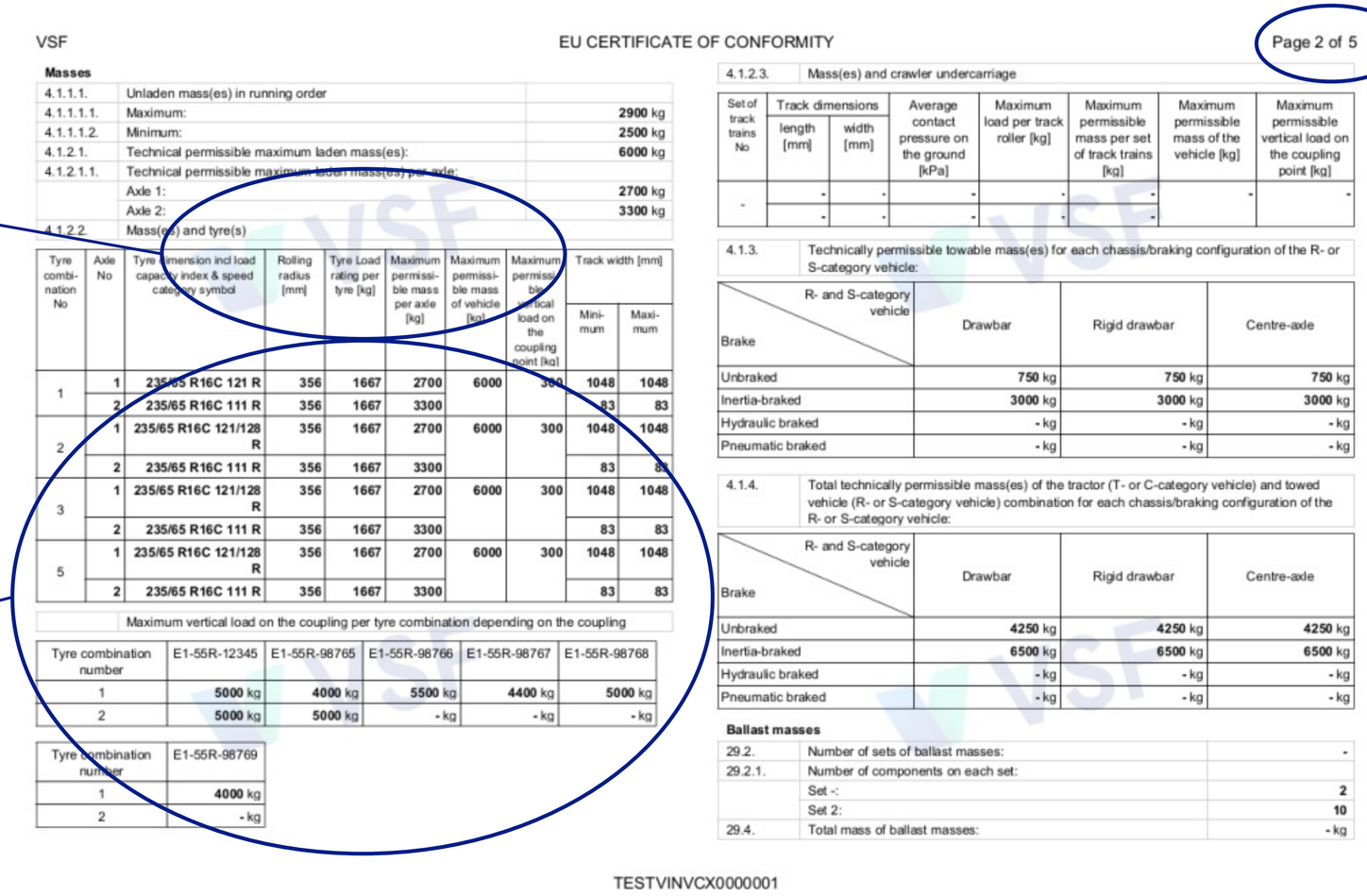

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Tyre combination number	E1-55R-98769
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2	- kg

4.1.2.3. Mass(es) and crawler undercarriage

Set of track trains No	Track dimensions: length [mm]	Track dimensions: width [mm]	Average contact pressure on the ground [kPa]	Maximum load per track roller [kg]	Maximum permissible mass per set of track trains [kg]	Maximum permissible mass of the vehicle [kg]	Maximum permissible vertical load on the coupling point [kg]
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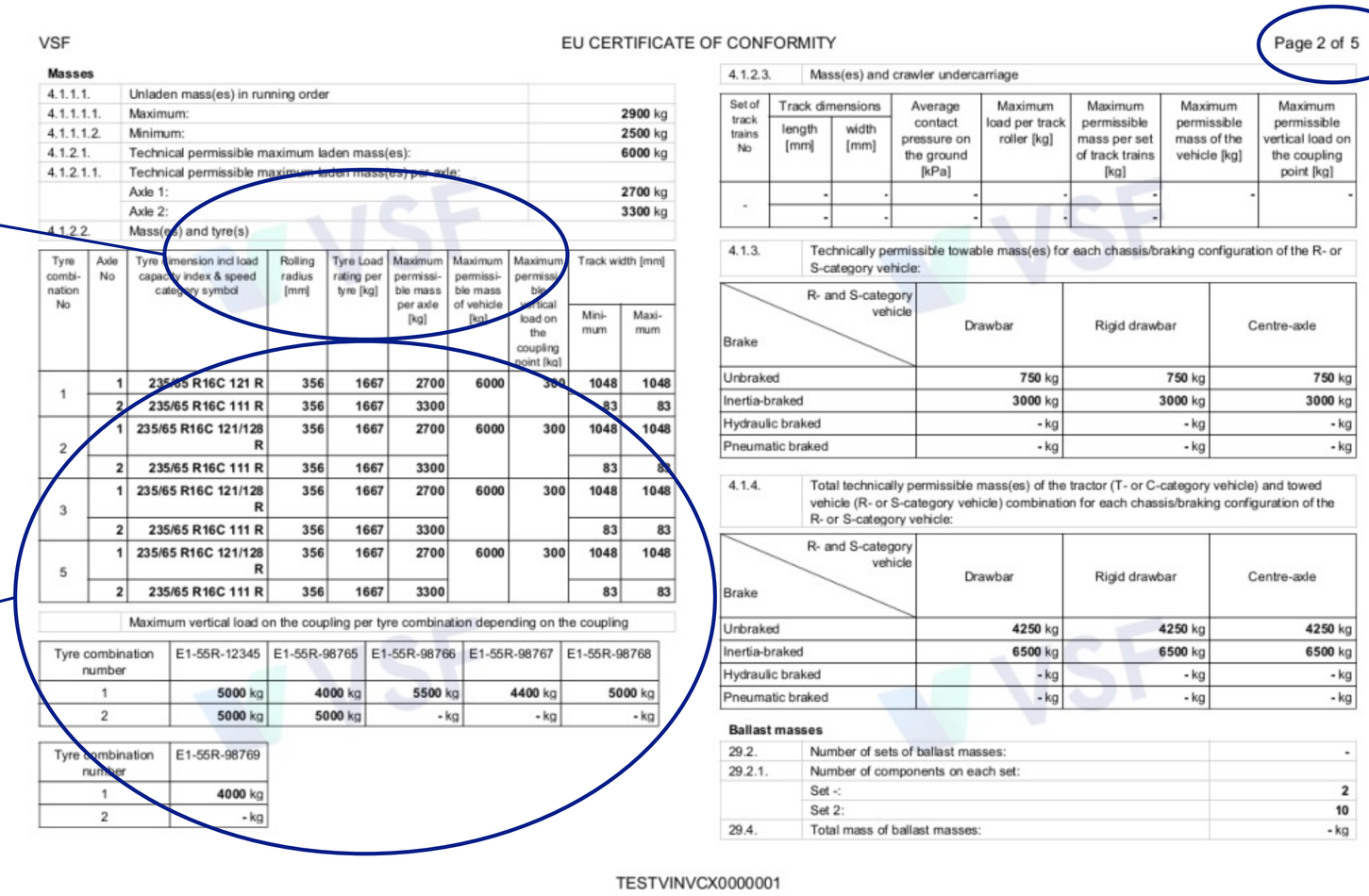
...



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-	-	-	-	-	-	-	-
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Paper thoughts vs. Data thoughts

Printing on paper

- Needs corporate design
- How to fit on one A4?
- How to fit tables into the design?
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Paper thoughts vs. Data thoughts

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Sending data

- How to authenticate?
- How to avoid manipulation of data?
- How to ensure secure transmission of data?
- How to handle exceptions?

Outlook: Towards a living documentation?

Paper documents

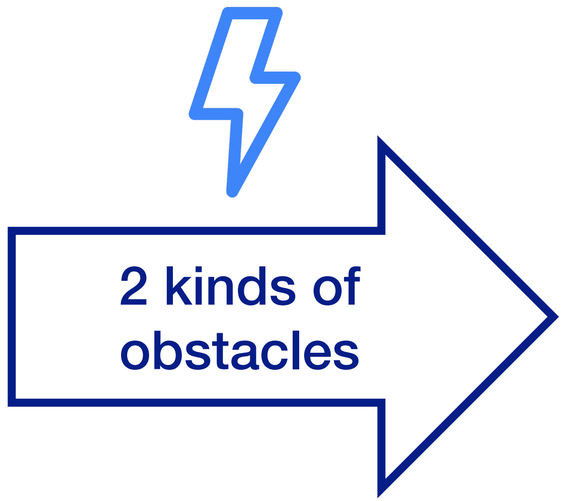
- Do not change
- CoC as „birth certificate“
- Need to be carried along

Data

- Can be updated
- Can have a version and history
- Are transparent and accessible

Reality check: A paradigm shift takes time

Mixture of paper and data processes



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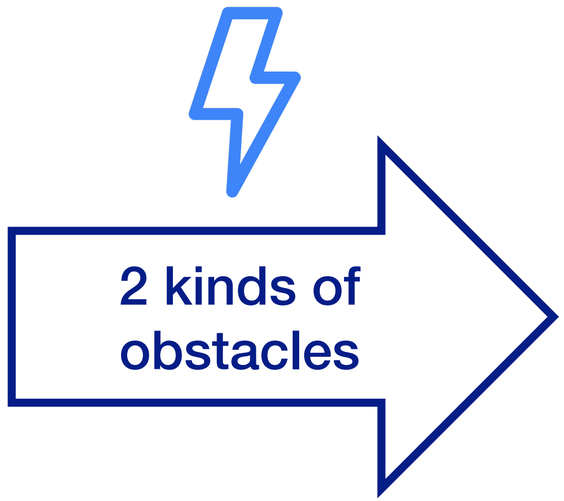
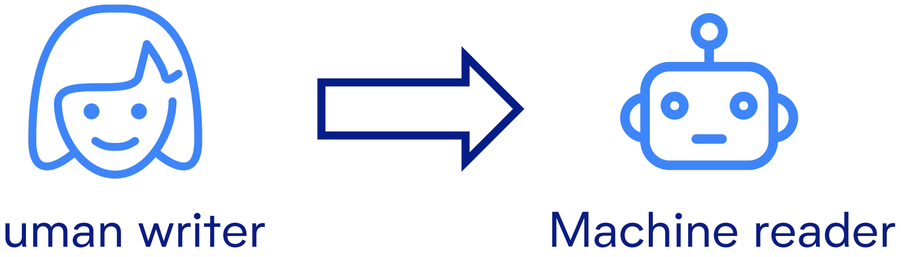
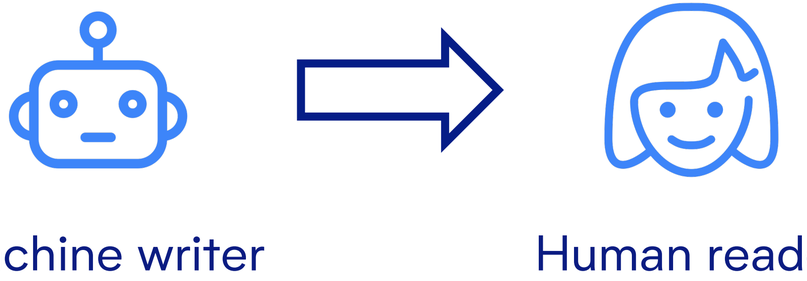
Mixture of paper and data processes







Recommendations

Some learnings from implementing electronic COCs

Start being strict on formalities

Some examples:

- Number of wheels: „2 (optionally 4)“

  → this will not be possible in a number field, only comment field as workaround available

- Explanatory footnotes on tyre combinations

  → there are no field related comments at all in the IVI

- Tyre combination tables and coupling tables as images or attachments

  → For a printout solution, this is fine, but electronic documents require the contents

Thinking in objects

General construction characteristics

3.3.1.	Number of axles and wheels:	2 / 4
3.3.2.	Number and position of axles with twinned wheels:	
3.3.3.	Number and position of steered axles:	F
3.3.4.	Number and position of powered axles:	R
3.3.5.	Number and position of braked axles:	R
3.4.1.	Crawler undercarriage configuration:	-
3.4.2.	Number and position of powered set of track trains:	-

4.1.2.1.	Technical permissible maximum laden mass(es):	6.000 kg
4.1.2.1.1.	Technical permissible maximum laden mass(es) per axle:	
	Axle 1:	2.700 kg
	Axle 2:	3.300 kg
4.1.2.2.	Mass(es) and tyre(s)	

Tyre combination No	Axle No	Tyre dimension incl load capacity index & speed category symbol	Rolling radius [mm]	Tyre Load rating per tyre [kg]	Maximum permissible mass per axle [kg]	Maximum permissible mass of vehicle [kg]	Maximum permissible vertical load on the coupling point [kg]	Track width [mm]	
								Minimum	Maximum
1	1	235/65 R16C 121 R	356	1.667	2.700	6.000	300	1.048	1.048
	2	235/65 R16C 121 R	356	1.667	3.300			83	83
2	1	240/65 R16C 124 R	365	1.850	2.700	6.000	300	1.048	1.048
	2	240/65 R16C 124 R	365	1.850	3.300			83	83

4.2.2.5.	Wheelbase:	1.980 mm
4.2.2.8.	Track width:	
	Maximum	
	Axle 1:	1.048 mm
	Axle 2:	1.048 mm
	Minimum	
	Axle 1:	1.048 mm
	Axle 2:	1.048 mm

General powertrain characteristics

CoC: Distributed information on axles

IVI: all information on one Axle object

```
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                <SpeedCategorySymbol>R</SpeedCategorySymbol>
                (...)
            </TyreAxleGroup>
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    </AxleGroup>
</AxleTable>
```

Flexible data structures and processes

Rigid database structures will fail on change

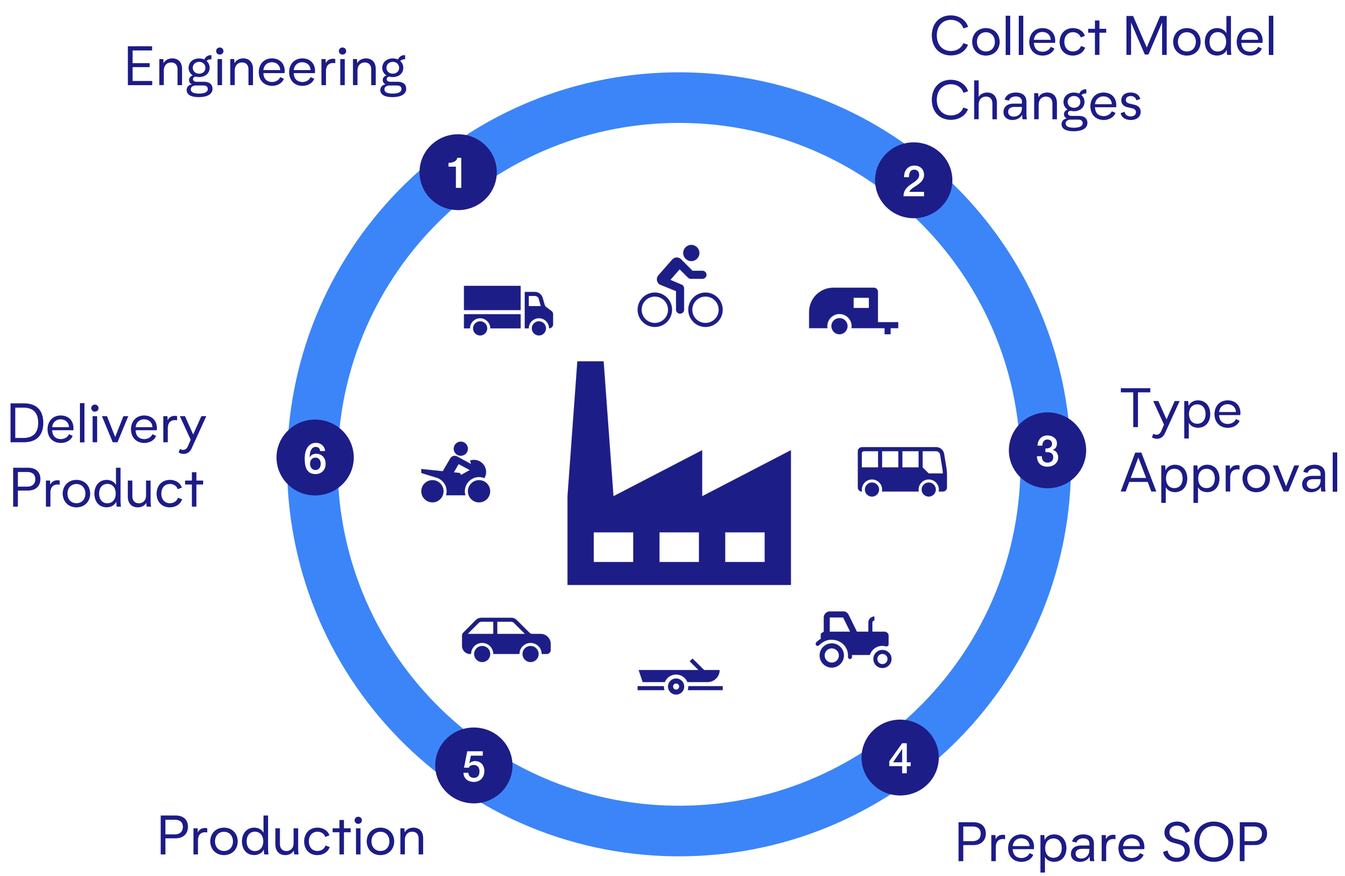
„Hard-coding“ a strict rigid workflow will be costly on change

Versioned JSON or XML schemata can handle updates easily

Configurable workflows and rules to extend and adjust if needed

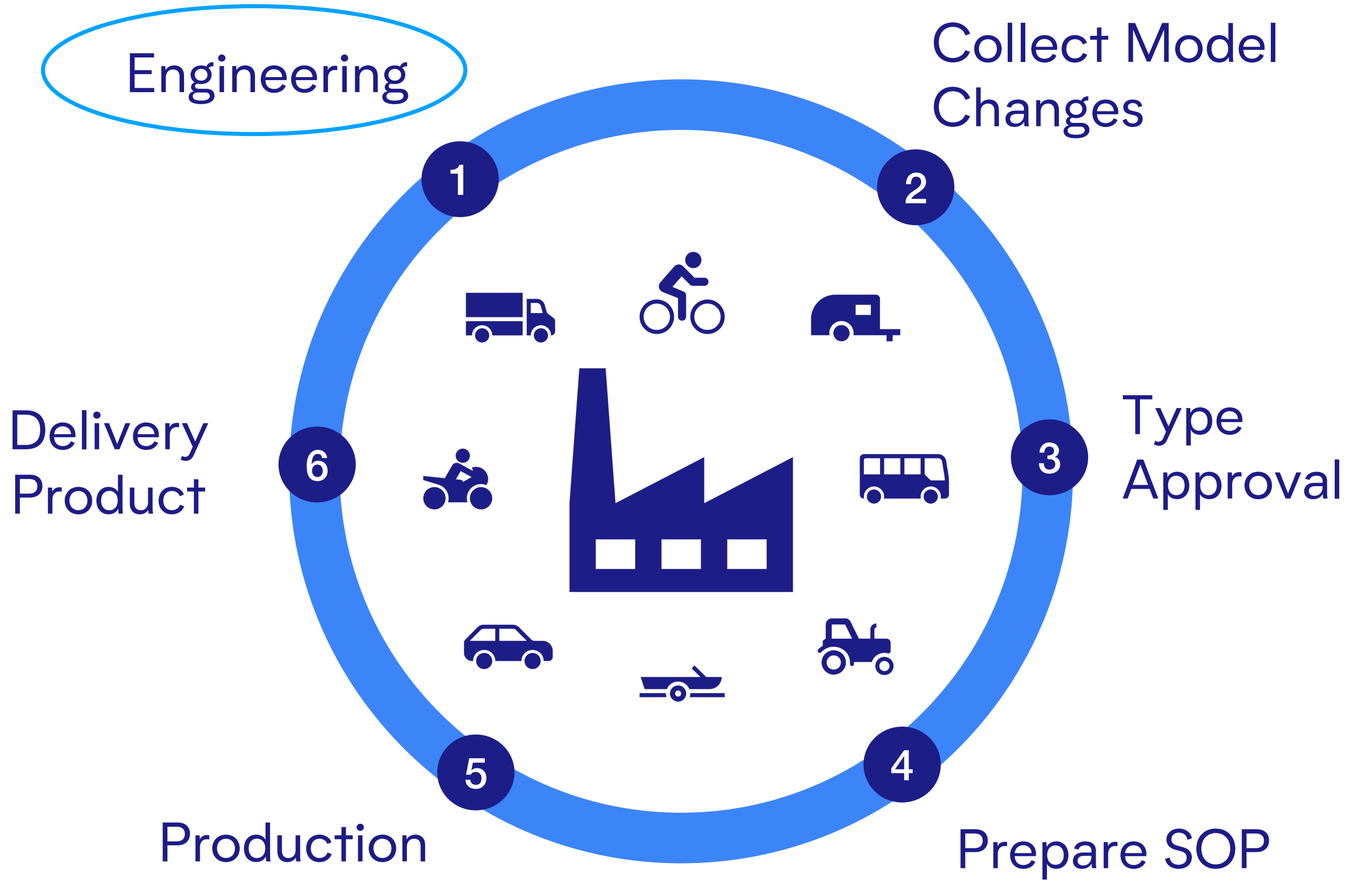
Involve IT to find the best solutions!

Data collection early in the process



Data collection early in the process

Data are produced here...



Data collection early in the process

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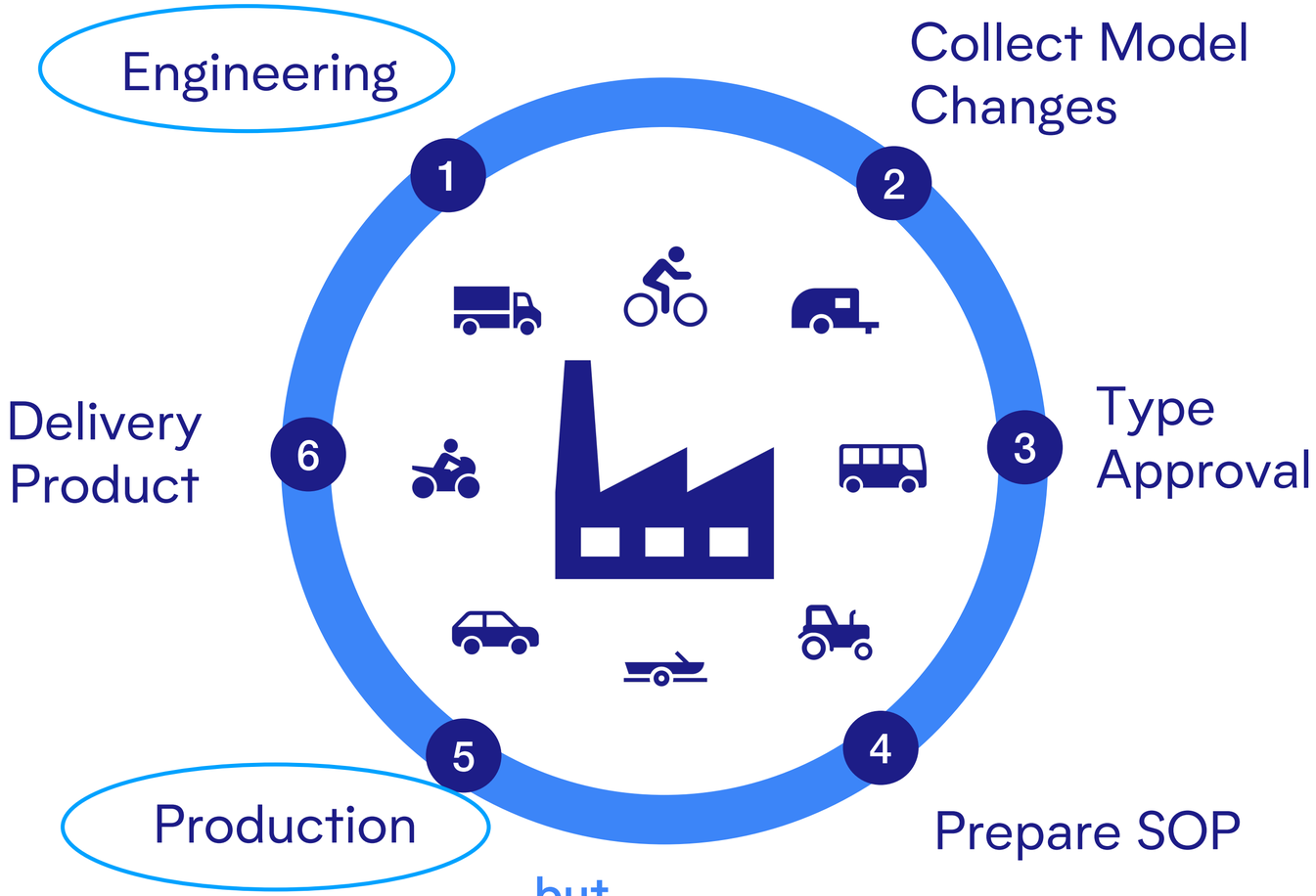
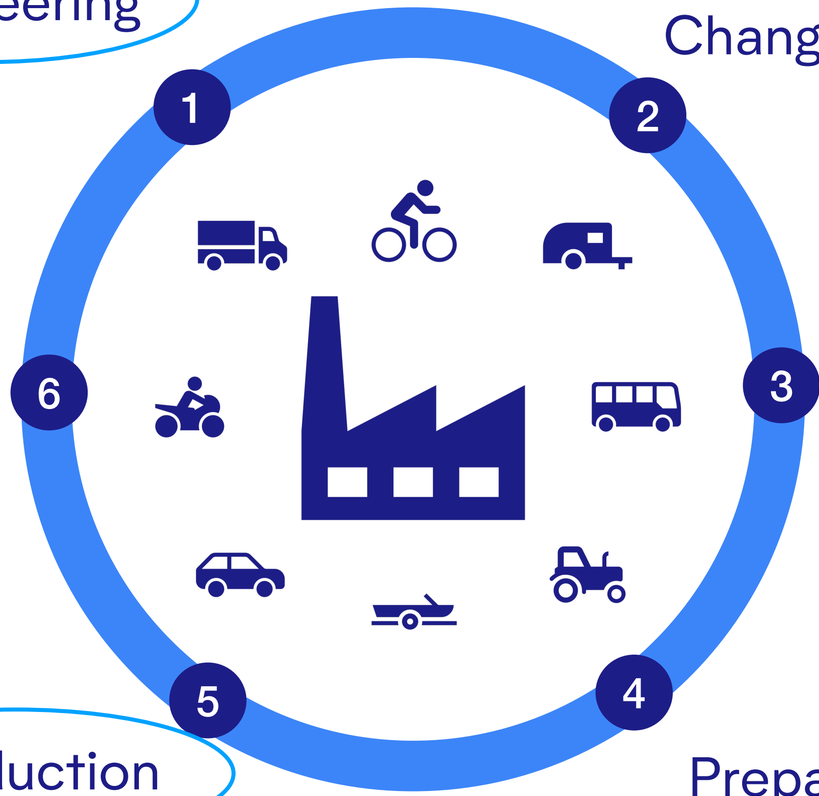


... but consumed here

Data collection early in the process

Data are produced here...

Engineering



Collect Model Changes

Type Approval

Prepare SOP

Production

... but consumed here

Delivery Product

Avoid finding out problems here!

Outlook: Digital Type Approvals

- Extracting data into attachments will vanish
- Quicker approval processes will make iterations more frequent
- Data exchange and collaboration between all stakeholders will become an important factor

Thank you! Any questions?

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