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Item 4 of the provisional agenda
Regulation No. 55

Proposal for amendments to Regulation No. 55 (Mechanical couplings)

Submitted by the Chair of the informal group on Regulation No. 55*

The text reproduced below was prepared by the experts of the informal working group on Regulation No. 55 and introduces amendments on:

(a) An amendment for the separation of the procedures to verify towable mass from the procedure of setting and certifying performance values;

(b) An amendment that adds procedures to verify towable mass for vehicle combinations that have hitherto not been accounted for in the Regulation;

(c) Amendments that adds integrated fixing points for secondary couplings;

(d) An amendment that clarifies the procedure to identify worst cases for certification testing;

(e) Amendments that removes typos in the current Regulation.

The modifications to the existing text of the Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2016–2017 (ECE/TRANS/254, para. 159 and ECE/TRANS/2016/28/Add.1, cluster 3.1), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

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I. Proposal

Insert new paragraph 1.2.1.1., to read:

"1.2.1.1. For the purpose of this Regulation a dolly is defined as a towing trailer designed for the sole purpose to tow a semi-trailer."

Paragraph 2.11., amend to read:

"2.11. The characteristic values D, Dc, S, V**,** ~~and~~ U **and A_v** are defined ~~or~~ **and** ~~determined~~ **verified** as:"

Paragraph 2.11.1., amend to read:

"2.11.1. ~~The D or Dc value is the theoretical reference value for the horizontal forces in the towing vehicle and the trailer and is used as the basis for horizontal loads in the dynamic tests.~~

~~For mechanical coupling devices and components not designed to support imposed vertical loads, the value is:~~

~~$D = g\frac{T \cdot R}{T + R}\ kN$~~

~~For mechanical coupling devices and components for centre axle trailers as defined in 2.13, the value is:~~

~~$D_c = g\frac{T \cdot C}{T + C}\ kN$~~

~~For fifth wheel couplings of Class G, fifth wheel coupling pins of Class H and mounting plates of Class J, as defined in paragraph 2.6., the value is:~~

~~$D = g\frac{0.6 \cdot T \cdot R}{T + R - U}\ kN$~~

~~Where:~~

~~T is the technically permissible maximum mass of the towing vehicle, in tonnes. Where relevant, this includes the vertical load imposed by a centre axle trailer.[1]~~

~~R is the technically permissible maximum mass, in tonnes, of a trailer with drawbar free to move in a vertical plane, or of a semitrailer.[2]~~

~~C is the mass, in tonnes, transmitted to the ground by the axle or axles of the centre axle trailer, as defined in paragraph 2.13., when coupled to the towing vehicle and loaded to the technically permissible maximum mass.[2] For Category O1 and O2 centre axle trailers[2] the technically~~

[1] ~~The mass T and R and the technically permissible maximum mass, may be greater than the permissible maximum mass prescribed by national legislation.~~

[2] ~~See definitions in Regulation No. 13 annexed to the 1958 Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions. The definition is also contained in the Consolidated Resolution on the Construction of Vehicles (R.E.3) (document TRANS/WP.29/78/Rev.3, para.2).~~

~~permissible maximum mass will be that declared by the manufacturer of the towing vehicle.~~

~~g is the acceleration due to gravity (assumed to be 9.81 m/s2)~~

~~U is as defined in paragraph 2.11.2.~~

~~S is as defined in paragraph 2.11.3.~~

The D and D_c value are characteristic performance values for the horizontal forces of the coupling equipment verified as described in Annex 6 of this Regulation."

Paragraph 2.11.2. amend to read:

"2.11.2. ~~The U value is the vertical mass, in tonnes, imposed on the fifth wheel coupling by the semitrailer of technically permissible maximum mass.~~[2]

The U value is a characteristic performance value for the vertically imposed mass, in tonnes, on the fifth wheel coupling. This performance value shall be verified as described in Annex 6 of this Regulation."

Paragraph 2.11.3. amend to read:

"2.11.3. ~~The S value is the vertical mass, in kilograms, imposed on the coupling, under static conditions, by the centre axle trailer, as defined in paragraph 2.13., of technically permissible maximum mass.~~[2]

The S value is a characteristic performance value for the vertically imposed mass, in kilograms, to the coupling from a center axle trailer under static conditions. This performance value shall be verified as described in Annex 6 of this Regulation."

Paragraph 2.11.4., amend to read:

"2.11.4. ~~The V value is the theoretical reference value of the amplitude of the vertical force imposed on the coupling by the centre axle trailer of technically permissible maximum mass greater than 3.5 tonnes. The V value is used as the basis for vertical forces in the dynamic tests.~~

~~$V = \frac{a \cdot C \cdot X^2}{L^2}$ (See the Note below)~~

~~Where:~~

~~a is an equivalent vertical acceleration at the coupling depending on the type of suspension system of the rear axle of the towing vehicle.~~

~~For air suspension (or suspension systems with equivalent damping characteristics)~~

~~a = 1.8 m/s2~~

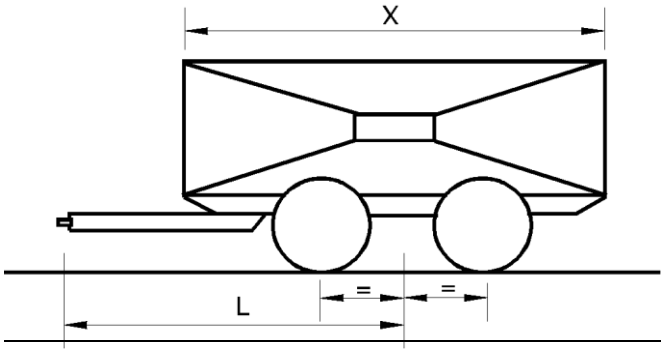
~~For other types of suspension:~~

~~a = 2.4 m/s2~~

~~X is the length of the loading area of the trailer, in metres (see Figure 1)~~

~~L is the distance from the centre of the drawbar eye to the centre of the axle assembly, in metres (see Figure 1)~~

~~*Note:* $\frac{X^2}{L^2} \geq 1.0$ (If less than 1.0, the value of 1.0 shall be used)~~



~~Figure 1~~
~~Dimensions of the centre axle trailer~~

The V value is a characteristic performance value of the amplitude of the vertical force imposed on the coupling by a center axle trailer. This performance value shall be verified as described in Annex 6 of this Regulation."

Insert new paragraph 2.11.5., to read:

"2.11.5. The A_v value is a characteristic performance value for hinged drawbars that sets maximum permitted axle mass in tonnes of the front steered axle group of a full trailer. This performance value shall be verified as described in Annex 6 of this Regulation."

Insert new paragraph 2.11.6. to read:

"2.11.6. To each of the characteristic performance value D, Dc, U, V and S there are corresponding application requirement values. Those requirements values are determined according to Annex 8 of this Regulation."

Paragraph 2.12., amend to read:

"2.12. Symbols and definitions used in Annex 6 **and Annex 8** of this Regulation.

A_v = maximum permitted axle mass ~~of the steered axle in tonnes~~ **in tonnes of the front steered axle group of a full trailer – see paragraph 2.11.5.**

C = mass of centre axle trailer in tonnes – see **Annex 8** paragraph **2.1.** ~~2.11.1.~~ of this Regulation.

D = D-value in kN - see paragraph 2.11.1. of this Regulation.

D_c = D_c-value in kN for centre axle trailers - see paragraph 2.11.1. of this Regulation.

R = mass of towed vehicle in tonnes - see **Annex 8** paragraph **2.1.** ~~2.11.1.~~ of this Regulation.

T = mass of towing vehicle in tonnes - see **Annex 8** paragraph **2.1.** ~~2.11.1.~~ of this Regulation.

F_a = static lifting force in kN.

F_h = horizontal component of test force in longitudinal axis of vehicle in kN.

F_s = vertical component of test force in kN.

S = static vertical mass in kg. – **See paragraph 2.11.3. of this Regulation.**

U = fifth wheel imposed vertical mass in tonnes. – **See paragraph 2.11.2. of this Regulation.**

V = V-value in kN - see paragraph 2.11.4. of this Regulation.

a = equivalent vertical acceleration factor at the coupling point of centre axle trailers depending on the type of suspension of the rear axle(s) of the towing vehicle - see **Annex 8** paragraph **2.2.** ~~2.11.1.~~ of this Regulation. …"

Paragraph 2.16., amend to read:

2.16. ***"Secondary coupling device"*** means a chain, wire rope, etc., fitted to ~~a Class B coupling head as defined in paragraph 2.6.2~~ **a coupling device,** capable in the event of separation of the main coupling, of ensuring that the trailer remains connected to the towing vehicle and that there is some residual steering action.

Paragraph 4.8. (Former), shall be renumbered as paragraph 4.10.

Insert a new paragraph 4.8.

"**4.8.** **Towing brackets / drawbeams which are intended to tow trailers up to 3.5t shall incorporate attachment points, to which either secondary couplings or devices necessary to enable the trailer to be guided and/or stopped automatically in the event of separation of the main coupling, may be attached. Other than for detachable units, as an alternative, an attachment point may be integrated to coupling component fitted to the towing bracket/drawbeam. The installation and operating instructions specified in 4.6. shall include all the information for the correct use these attachment points."**

4.8.1. **The attachment points for a secondary coupling and/or breakaway cable shall be positioned such that when in use, the secondary coupling or breakaway cable does not restrict the normal articulation of the coupling or interfere with the normal inertia braking system operation. A single attachment point shall be positioned within 100 mm of a vertical plane passing through the center of articulation of the coupling. If this is not practicable, two attachment points shall be provided, one on each side of the vertical center line and equidistant from the center line by a maximum of 250 mm. The attachment point(s) shall be as rearward and as high as practicable.**

4.8.2. **The attachment points above shall comply with the requirement defined in paragraph 3.1.8. of Annex 6**"

Insert a new paragraph 4.9., to read:

"**4.9.** **Coupling heads/ coupling drawbar eyes, intended to be fitted to un-braked O_1 trailers, shall be fitted with a secondary coupling device or at least attachment point(s) to permit the connection of a secondary coupling device(s).**

4.9.1. **The attachment point(s) shall be positioned such that when in use, the secondary coupling device(s) does not restrict the normal articulation of the coupling.**

4.9.2. **The attachment point(s) above shall comply with the requirement defined in paragraph 3.2.4. of Annex 6.**"

Paragraph 5.3.5., amend to read:

"5.3.5. A statement of the **characteristic performance** values of D, D_c, S, V and U as applicable and as defined in paragraph 2.11."

Paragraph 5.3.5.1., amend to read:

"5.3.5.1. The characteristic performance values **of the coupling equipment installed on the vehicle** shall be ~~at least equal to~~ **forces, determined verified according to Annex 8 of this Regulation applying** the maximum permissible towing vehicle, trailer and combination masses."

Annex 2, add new item 6. to read:

6. Maximum permissible masses

Annex 2, current item 6., renumbered and amended to read:

6.1. Two-vehicle combinations

Maximum permissible vehicle mass: ..... kg
Distribution of maximum permissible vehicle mass between the axles:
.....
Maximum permissible towable trailer mass: ..... kg
Maximum permissible static mass on coupling ball: ..... kg

Annex 2, add new item 6.2. ***to read:***

6.2. Multi vehicle combinations [according to annex 8]

Maximum permissible combination mass: ..... kg
Maximum permissible vehicle mass: ..... kg
Distribution of maximum permissible vehicle mass between the axles:
.....
Maximum permissible towable mass..... kg
Limiting V-value (as applicable) ..... kN

Annex 2, item 7., amend to read:

"7. **Performance values of coupling equipment installed:**
D..... kN D_c..... kN S..... kg

U..... tonnes V..... kN

In case of a towing trailer, performance values of the coupling equipment installed at the rear:

D..... kN D_c..... kN S..... kg

U..... tonnes V..... kN"

Annex 5,

Paragraphs 1.6. and 1.6.1., shall be deleted:

Paragraphs 1.7. and 1.8. (former) shall be renumbered as *Paragraphs1.6. and 1.7.*

Paragraph 2.1. amend to read:

"2.1. Coupling heads of Class B50 shall be designed so that they can be used safely with the coupling balls described in paragraph 1. of this annex and thereby retain the prescribed characteristics.

~~Coupling heads, for a tractive force up to 800 kg and intended to be fitted to un-braked O_1 trailers, shall be fitted with a secondary coupling device or at least attachment point(s) to permit the connection of a secondary coupling~~

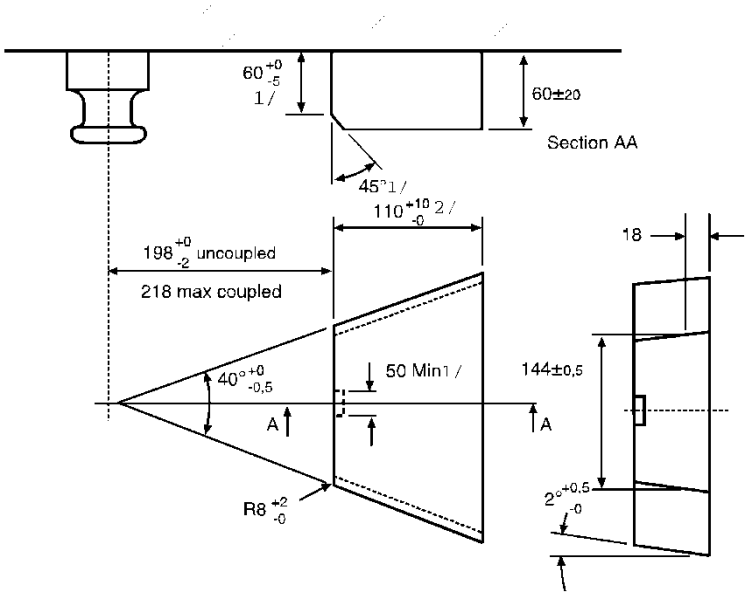
~~device(s). The attachment point(s) shall be positioned such that when in use, the secondary coupling device(s) does not restrict the normal articulation of the coupling.~~

Coupling heads shall be designed in such a way that safe coupling is ensured, also taking into account the wear of the coupling devices."

Figure 12, amend as follow:

"…Change dimension sleeve bore diameter Ø06H8 to Ø60H8…"

Figure 17, amend to read:



Annex 6,

Paragraph 1.1., amend to read:

"1.1. Samples of coupling devices shall be tested for both strength and function. **Tests shall be performed in relation to worst case conditions.**

Theoretical assessment may be carried out to determine worst case conditions Physical testing shall be carried out wherever possible but unless stated otherwise the Type Approval Authority or Technical Service may waive a physical strength test if the simple design of a component makes a theoretical ~~check~~ **assessment** possible.

~~Theoretical checks may be carried out to determine worst case conditions.~~ In all cases, theoretical ~~checks~~ **assessments** shall ensure the same quality of results as with dynamic or static testing. In cases of doubt it is the results of physical testing that are overriding.

See also paragraph ~~4.8.~~ **4.10.** of this Regulation."

Paragraph 3.1.8., amend to read:

"3.1.8. The attachment points for the secondary coupling referred to ~~in Annex 5~~, paragraph ~~1.5.~~**4.8.** shall withstand a horizontal static force equivalent to 2D with a maximum of 15 kN. Where there is a separate attachment point for a breakaway cable this shall withstand a horizontal static force equivalent to D."

Paragraph 3.2.4., amend to read:

"3.2.4. The secondary coupling device(s) attachment point(s) referred to in ~~Annex 5~~, paragraph ~~2.1~~.**4.9.** shall withstand a static force equivalent to 2D with a maximum of 15 kN"

Paragraph 3.6.1., amend to read:

"3.6.1. Drawbars shall be tested in the same way as drawbar eyes (see paragraph 3.4.). The Type Approval Authority or Technical Service may waive an endurance test if the simple design of a component makes a theoretical ~~check~~ **assessment** of its strength possible. The design forces for the theoretical verification of the drawbar of centre axle trailers with a mass, C, of up to and including 3.5 tonnes shall be taken from ISO 7641/1:1983. The design forces for the theoretical verification of drawbars for centre axle trailers having a mass, C, over 3.5 tonnes shall be calculated as follows:

Fsp = (g × S/1000) + V

Where the force amplitude V is that ~~given~~ **defined** in paragraph 2.11.4. of this Regulation.

The permissible stresses based on the design masses for trailers having a total mass, C, over 3.5 tonnes shall be in accordance with paragraph 5.3. of ISO 7641/1:1983. For bent drawbars (e. g. swan neck) and for the drawbars of full trailers, the horizontal force component Fhp = 1.0 × D shall be taken into consideration."

Add New Annex 8, to read:

"

Annex 8

Verification procedure for vehicle with respect to coupling equipment installed

1. General

The objective of this annex is to provide a procedure and acceptance criterion to verify that the characteristic performance values of the coupling equipment installed on the vehicle to be approved are sufficient to sustain the maximum towable mass and other technical characteristics of the vehicle / combination.

1.1 Verification procedure and acceptance criteria

The performance value requirements shall be calculated using the relevant formulae of paragraphs 2 and 3 of this annex, applying the maximum permissible towing vehicle, trailer and combination masses which are specified by the vehicle manufacturer in the Annex 2 of this Regulation.

The acceptance criteria are fulfilled:

- **if the calculated performance value requirements are not higher than the characteristic performance values of the coupling equipment,**

- **if, in case of a drawbar coupling not fulfilling the above criteria, the calculated performance value requirements and the limiting V-value specified by the vehicle manufacturer fulfill all the criteria specified in paragraph 4 of this annex.**

2. Calculation formulae applicable to Two-vehicle combinations

2.1. Horizontal forces

For mechanical coupling devices and components not designed to support imposed vertical loads, the value is:

$$D = g\frac{T*R}{T+R}$$ **kN**

For mechanical coupling devices and components for center axle trailers as defined in 2.13, the value is:

$$D_C = g\frac{T*C}{T+C}$$ **kN**

For fifth wheel couplings of Class G, fifth wheel coupling pins of Class H and mounting plates of Class J, as defined in paragraph 2.6., the value is:

$$D = g\frac{0.6*T*R}{T+R-U}$$ **kN**

where:

T is the technically permissible maximum mass of the towing vehicle, in tonnes. Where relevant, this includes the vertical load imposed by a center axle trailer[3].

R is the technically permissible maximum mass, in tonnes, of a trailer with drawbar free to move in a vertical plane, or of a semitrailer[3].

C is the mass, in tonnes, transmitted to the ground by the axle or axles of the center axle trailer, as defined in paragraph 2.13., when coupled to the towing vehicle and loaded to the technically permissible maximum mass[3]. For Category O1 and O2 center axle trailers[4] the technically permissible maximum mass will be that declared by the manufacturer of the towing vehicle.

Towable mass: R or C (as applicable)

2.2. Vertical forces from center axle trailer

The vertical force imposed on the coupling by the center axle trailer of technically permissible maximum mass greater than 3.5 tonnes is:

$$V = \frac{a*C*X^2}{L^2}$$ **kN (See the Note below)**

where:

C is as defined in paragraph 2.1. of this Annex

[3] **The mass T and R and the technically permissible maximum mass, may be greater than the permissible maximum mass prescribed by national legislation.**

[4] **See definitions in Regulation No. 13 annexed to the 1958 Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions. The definition is also contained in Annex 7 of the Consolidated Resolution on the Construction of Vehicles (R.E.3) (document TRANS/WP.29/78/Rev.4).**

a is an equivalent vertical acceleration at the coupling depending on the type of suspension system of the rear axle of the towing vehicle.

For air suspension (or suspension systems with equivalent damping characteristics)

$a = 1.8\ m/s^2$

For other types of suspension:

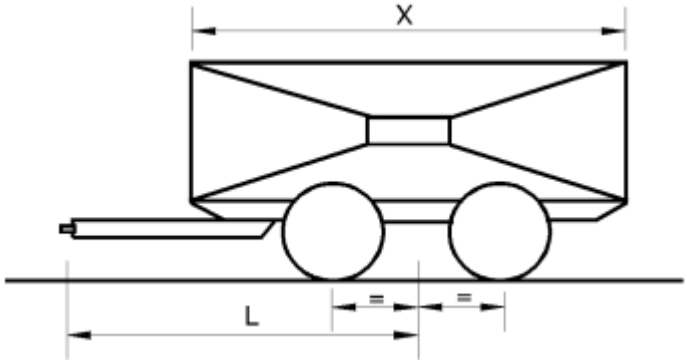
$a = 2.4\ m/s^2$

X is the length of the loading area of the trailer, in meters (see Figure 27)

L is the distance from the center of the drawbar eye to the center of the axle assembly, in meters (see Figure 27)

Note: $\frac{X^2}{L^2} \geq 1.0$ **(If less than 1.0, the value of 1.0 shall be used)**

Figure 27
Dimensions of the center axle trailer



Towable mass: C

3. Calculation formulae applicable to Multi-vehicle combinations

3.1. Combination 1:

Description: Rigid truck + Dolly + Semitrailer

Masses [tonnes]:

M_1 = total axle load of rigid truck as coupled

M_2 = total axle load of dolly and semitrailer as coupled

M_3 = total axle load of dolly as coupled

M_4 = total axle load of rigid truck as coupled plus tare weight of dolly

M_5 = support load at king-pin of semitrailer

$M_6 = M_5$ + total axle load of semitrailer as coupled

Total combination mass = $M_1 + M_2$

Towable mass of the rigid truck: M_2

Towable mass of the dolly: M_6

Dimensions:

L = distance from drawbar eye to center of dolly axle group [m]

Coupling capability requirement:

Clevis coupling: $D = g\frac{M_1 * M_2}{M_1 + M_2}$ † $V = Max(\frac{54}{L}; 5\frac{M_3}{L})$†

Fifth wheel: $D = 0.5g\frac{M_4(M_6 + 0{,}08M_4)}{M_4 + M_6 - M_5}$

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† **Dolly with <u>rigid drawbar</u>:**

This calculated D-value requirement shall be lower than the certified D_C-value performance of coupling equipment used.

Dolly with <u>hinged drawbar</u>:

This calculated D-value requirement shall be lower than the certified D-value performance of coupling equipment used. With a hinged drawbar there is no V-value requirement.

3.2. Combination 2:

Description: <u>Tractor + Semitrailer + center axle trailer</u>

Masses [tonnes]:

M_1 = total axle load of tractor as coupled (including support load from semitrailer)

M_2 = total axle load of center axle trailer as coupled

M_3 = total axle load of tractor and semitrailer as coupled

M_4 = support load at king-pin of semitrailer

M_5 = M_4 + total axle load of semitrailer and center axle trailer as coupled

Total combination mass = M_2 + M_3

Towable mass of the tractor: M_5

Towable mass of the semitrailer: M_2

Dimensions:

L = distance from drawbar eye to center of center axle trailer axle group [m]

X = length of loaded area of center axle trailer [m]

a = 2.4 [m/s^2] for semitrailer with steel suspension; 1.8 [m/s^2] for semitrailer with air suspension

Coupling capability requirement:

Clevis coupling on semitrailer: $D_c = 0.65g\frac{M_3 * M_2}{M_3 + M_2}$ $V = a\frac{X^2}{L^2}M_2$

Fifth wheel: $D = 0.5g\frac{M_5(M_1 + 0{,}08M_5)}{M_1 + M_5 - M_4}$

Note: $\frac{X^2}{L^2} \geq 1.0$ **(If less than 1.0, the value of 1.0 shall be used)**

3.3. Combination 3:

Description: Tractor + Semitrailer + Dolly + Semitrailer

Masses [tonnes]:

M_1 = total axle load of tractor as coupled (including support load from first semitrailer)

M_2 = total axle load of tractor and first semitrailer as coupled

M_3 = M_4 + total axle load of second semitrailer as coupled

M_4 = total axle load of dolly as coupled (including support load from second semitrailer)

M_5 = M_2 + tare weight of dolly

M_6 = support load at king-pin of first semitrailer

M_7 = support load at king-pin of second semitrailer

M_8 = M_7 + total axle load of second semitrailer as coupled

M_9 = M_6 + total axle load of first semitrailer as coupled + M_3

Total combination mass = M_2 + M_3

Towable mass of the tractor: M_9

Towable mass of the first semitrailer: M_3

Towable mass of the dolly: M_8

Dimensions:

L = distance from drawbar eye to center of dolly axle group [m]

Coupling capability requirement:

Clevis coupling on first semitrailer:

$$D = 0.65g\frac{M_2 * M_3}{M_2 + M_3}$$ †

$$V = Max(\frac{54}{L}; 5\frac{M_4}{L})$$ †

Fifth wheel: $D = Max(D_1; D_2)$**, with:**

$$D_1 = 0.5g\frac{M_5(M_8 + 0,08M_5)}{M_5 + M_8 - M_7}$$

$$D_2 = 0.5g\frac{M_9(M_1 + 0,08M_9)}{M_9 + M_1 - M_6}$$

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† **Dolly with <u>rigid drawbar</u>:**
This calculated D-value requirement shall be lower than the certified D_C-value performance of coupling equipment used.

Dolly with <u>hinged drawbar</u>:
This calculated D-value requirement shall be lower than the certified D-value performance of coupling equipment used. With a hinged drawbar there is no V-value requirement.

3.4. Combination 4:

Description: <u>Rigid truck + center axle trailer + center axle trailer</u>

Masses [tonnes]:

M_1 = total axle load of rigid truck as coupled

M_2 = total axle load of first center axle trailer as coupled

M_3 = total axle load of second center axle trailer as coupled

$M_4 = M_2 + M_3$

$M_5 = M_1 + M_2$

Towable mass of the rigid truck: M_4

Towable mass of the first center axle trailer: M_3

Total combination mass = $M_1 + M_2 + M_3$

Dimensions:

L_1 = distance from drawbar eye to center of the axle group of the first center axle trailer [m]

L_2 = distance from drawbar eye to center of the axle group of the second center axle trailer [m]

X_1 = length of loaded area of the first center axle trailer [m]

X_2 = length of loaded area of the second center axle trailer [m]

T_1 = distance from center of axle group to coupling point of clevis coupling in rear end of first center axle trailer [m]

a = 2.4 [m/s^2] for semitrailer with steel suspension; 1.8 [m/s^2] for semitrailer with air suspension

Coupling capability requirement:

Clevis couplings:

$$D = 0.9g\frac{M_1 * M_4}{M_1 + M_4}$$

$$V = V_1$$

$$V_2 = a\frac{X_2^2}{L_2^2}M_3$$

$$V_1 = \sqrt{\left(a\frac{X_1^2}{L_1^2}M_2\right)^2 + \left(\frac{T_1^2}{L_1^2}V_2\right)^2}$$

Note: (If less than $\frac{X_1^2}{L_1^2} \geq 1$ $\frac{X_2^2}{L_2^2} \geq 1$ **1.0, the value of 1.0 shall be used)**

3.5. Combination 5:

Description: <u>Tractor + Link-trailer* + Semitrailer</u>

Masses [tonnes]:

M_1 = total axle load of tractor as coupled (including support load from link-trailer)

M_2 = support load at king-pin of link-trailer

$M_3 = M_2$ + total axle load of link-trailer and semitrailer as coupled

M_4 = total axle load of link-trailer and semitrailer as coupled

M_5 = support load at king-pin of semitrailer

$M_6 = M_5$ + total axle load of semitrailer

Total combination mass = $M_1 + M_4$

Towable mass of the tractor: M_3

Towable mass of the linktrailer: M_6

Coupling capability requirement:

Fifth wheel: $$D = 0.5g\frac{M_3(M_1+0{,}08M_3)}{M_1+M_3-M_2}$$

*** Link-trailer is a semitrailer equipped with a fifth wheel in its rear end enabling a second semitrailer to be towed.**

4. Performance extension

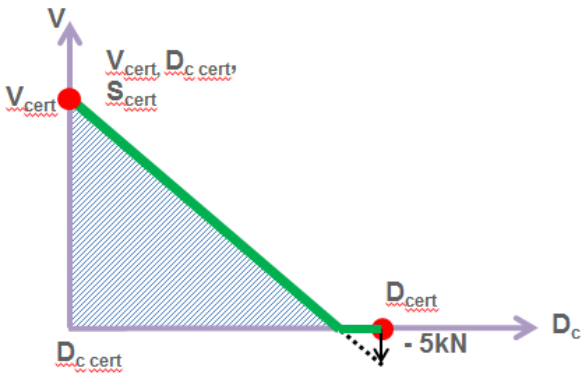
The designations D_{cert}, $D_{C\text{-}cert}$, V_{cert} and S_{cert} used below in this paragraph designate certified performance values of the ~~a~~ coupling component under consideration. The designation $D_{C\text{-}req}$, V_{req} and S_{req} designate vehicle combination performance value requirements as calculated in accordance with the rules in this annex. They are to be evaluated against certified performance values.

4.1. Clevis coupling systems including drawbeams and drawbar eyes

For each combination of certified performance values a diagram as shown in the Figure 28 may be drawn. Calculated performance value requirements $D_{C\text{-}req}$ and V_{req} that would fall in the hatched area of the diagram are allowed to be operated in road traffic.

S_{req} shall always be below or equal to 1000 kg.

Figure 28



4.2. If the calculated performance value requirements fall within the hatched area of figure 28, the towable mass is verified with a limiting V-value. For the combination concerned the limiting V-value overrules the certified V-value of the coupling equipment installed.

4.2.1. The limiting V-value is given by a point on the sloping line in figure 28. This point corresponds to the Dc-value requirement calculated for the towable mass."

II. Justification

1. Verification of towable mass

(a) Type approval of components in accordance with Regulation No. 55 can be done without using the formulae found in para. 2.11. (and subparagraphs) of the Regulation. The type approval of a vehicle is different as that type approval involves certifying towable

mass. Many elements such as "startability", gradeability, braking system capacity, cooling system capacity, etc. and of course coupling equipment capacity, govern towable mass for a truck or tractor. The formulae in the current Regulation can be used to verify the towable mass. However, this is not clearly mentionned in the Regulation.

(b) The D-value formula applicable for the combination of a rigid truck and a full trailer can be used to create an inverse function giving the towable mass. For the combination of a rigid truck and a centre axle trailer, the same does not apply. An inverse formula giving the towable mass in this combination can be derived using the D_c-value formula. However, the result is ambiguous. Depending on the dimensions of the centre axle trailer the V-value capacity of the coupling equipment might be decisive rather than the D_c-value capacity. The situation is similar for the D-value formulae for the combination of Tractor and semi-trailer. In this case, the default assumption for U according to Regulation No. 55 is 20 tonnes.

(c) More complex combinations highlight the ambiguity of the current procedures. Hence, the verifying procedure is designed to bring more clarity to the handling of the current two vehicle combinations as well as to the multivehicle combinations. Example given: for the multivehicle combination no. 1, there will occur vertical forces in the drawbar coupling i.e. calculated performance requirement, D_c to withstand longitudinal forces shall be compared to the certified characteristic performance D_c. For many components, it is known that the characteristic performance D_c is too low. In such case, the trade-off procedure under Annex 8 paragraph 4 can be explored. That will, if successful, result in a limiting V-value. For vehicles where the Annex 8 paragraph 4 option is used the limiting V-value shall be entered in to the information document for that vehicle in the relevant multivehicle combination.

(d) In Annex 2, additions have been made to enable handling of multivehicle combinations. The formulae of Annex 8 are those that are from two sources. Firstly those in paragraphs 2.11. (and subparagraphs) of the current Regulation and secondly there are formulae for multi vehicle combinations mirroring the standard ISO18868. Those formulae are to be used by:

(i) Vehicle manufacturers when prior to type approval setting towable mass applicable in two-vehicle combinations (as hitherto) and in multi-vehicle combinations.

(ii) Technical services at type approval verifying the towable mass set by the vehicle manufacturer.

2. Regulation No. 55 provides provisions for the type approval of a specific level of performance for coupling equipment and coupling installation. This can be done without knowing anything about the applications in which the coupling will be used. However, the regulator has realized that a certified performance does not provide enough confidence about the safety of coupling or coupling installation. There must exist a way to control to what extent the coupling equipment can be stressed in relation to the certified performance.

3. Hence the current version of Regulation No. 55 accounts for the application of coupling equipment in traditional vehicle combinations, i.e. rigid truck + full trailer, rigid truck + center axle trailer or tractor + semi-trailer.

4. Current transport systems use many different vehicle combinations that are not accounted for in Regulation No. 55 such as rigid truck + dolly + semi-trailer. A number of countries in Europe apply modular vehicle combinations. Outside Europe, combinations differing from the traditional two vehicle combinations are applied in many places. Those “new” combinations, with respect to coupling dimensioning, are handled in different ways in different countries, i.e. the level of safety is varying.

5. In order, for the regulator, to have control over a common safety level, more applications need to be included in the Regulation. The current version of the Regulation

contains the traditional applications integrated in the specification of the performance certification. Including the “new” applications in the same integrated way would risk making the Regulation very hard to read and interpret. Hence, the proposal brings all application related text in to one new Annex. On one hand, it clarifies the performance requirements for any application. On the other hand, the way to handle different applications becomes very easy to find. The proposed new Annex is drafted to offer an easy structure that will simplify the insertion of any future additional.

6. The traditional applications moved to the new Annex are handled just in the same way as it has been handled hitherto. The new applications introduced are the same as those in the ISO18868:2013 standard. The formulas used are also the same as agreed in that standard. This standard is based on Australian Regulations used since the mid-eighties. Before introducing those rules, Australia made extensive measurements. The processing of the ISO18868:2013 standard with in the ISO expert committee goes back to 2001. Hence it can be said that the formulae have been well scrutinized. During recent years many measurements of coupling forces in different vehicle combinations have been performed in Sweden. The results from those measurements have been compared to dimensioning using ISO18868:2013. The maximum forces registered from those measurements have all been found to be low in comparison to the dimensioning calculated using the formulae proposed.

7. Hence we find the proposal well founded.

8. For the sake of clarity, a definition of a dolly has been included. A dolly can have a rigid or a hinged drawbar. This puts different requirements on the coupling equipment connecting the dolly to the towing vehicle, i.e. with a rigid drawbar that coupling equipment shall withstand dynamic vertical forces generated by the dolly. This is not the case for a dolly with a hinged drawbar. Consequently, for a dolly with a rigid drawbar, the certified performance values Dc and V shall be compared to the calculated requirements. For a dolly with a hinged drawbar, there are no or negligible dynamic vertical forces generated in the clevis coupling. Hence for such dollies the certified performance value D shall be compared with the calculated requirement for longitudinal forces.

9. It is recognized that some markets (e.g. Australia) use the denomination "converter dolly". This implicates that a semi-trailer is converted to a full trailer by using a dolly. This is true when a dolly with hinged drawbar is used. This is not true in the case of a dolly with a rigid drawbar. In this latter case, a clevis coupling without certified V-value performance shall not be used. To make this very clear, the corresponding provision have been added in Annex 8, to clarify how to handle dollies with hinged and rigid drawbars respectively. In this way, a better clarity than in some "local" Regulations is achieved. It is noted that in some markets, no couplings without certified V-value performance are installed. In those markets the risk of using inferior clevis couplings is less pronounced.

10. Currently the way to identify worst case(s) is unclear. Therefore, the text in Annex 6, paragraph1.1. has been amended.

11. In Annex 6, paragraph1.1. and paragraph 3.6.1., the word "check" where applicable has been exchanged for the word "assessment" in order to make clear the action is towards an approval and not just a check.

12. It is proposed to correct two typos in Annex 5, figures 12 and 17.

13. The requirements defined in paragraphs 1.6. and 1.6.1. of Annex 5, paragraphs 2.1. of Annex 5 have been either suppressed totally or partially to be included in the paragraph 4 related to the general requirements. This allows to request the possibility to fix a secondary coupling and/or a brake away cable for un-braked O_1 trailers or inertia braked trailers up to 3,5t which are not only equipped with class B coupling heads but also with class S drawbar eyes (38 mm, 40 mm, and others).

14. Some manufacturers can provide both the towing brackets and the components fitted on. In that exclusive case, the attachment points may be integrated to the component.