Svensson Bolennarth

Ämne: VB: Concerning item 21

Från: Svensson Bolennarth
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Till: Anders Gunneriusson (anders.gunneriusson@transportstyrelsen.se); Jürgen Wästphäling
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Dear Anders and Jürgen,

I have been thinking a bit on the comments that we use from time to time in our meetings. "This regulation is for type approval purpose."

In this context I consider first the §2.10.x and §2.11x where the formulae for D, D_c and V is given. Those formulae are said to be " … a theoretical reference value … … is used as the basis for the horizontal /vertical load in dynamic tests." Taking a fundamentalistic position I would argue that there is no explicit requirements stated on what requirements the coupling equipment shall fulfill to be allowed to be used in the road transports. The closest I can find is in §3.2.3.1 and §5.3.5.1. However §3.2.3.1 is under the heading "application for approval of a mechanical coupling device or component". For a component this § is irrelevant as long as a specific application is not known. §5.3.5.1 is under vehicle approval but lacks a reference to some formulae , e.g. §§2.10.x and §§2.11.x. The general understanding is however that those latter formulae applies to calculate reference demand using "the maximum permissible towing vehicle, trailer and combination masses". This calculated demand shall then be compared with the actual characteristic value for the coupling equipment installed on the vehicle.

This is good and bad. As the regulation is currently only addressing combinations of a towing and a towed vehicle it is bad that it is not crystal clear how the demanded D, D_c and V values shall be calculated. Looking forward towards modular vehicle combinations it is good that there is an opening to set up different scenarios how the demanded values shall be calculated for different combinations.

In this situation we face a challenge how to specify the limiting values on the possible combinations. Today we state maximum towable mass with a full trailer and a center axle trailer. This is in accordance with the annex II of the 2007/46/EU. We may observe that the max towable mass with a center axle trailer is ambiguous as the design of the center axle trailer controls the V-value demand. Hence the towable mass may be lower than what is derived from the D_c-value formula. This is really in the boarder land between type approval and use of the vehicles. However as noted above in Europe that data is stated in the whole vehicle type approval information document.

The reason why I am thinking of this is really how to handle item 21 in our item list. The first thought that I had was that this shall really be an item in 96/52/EU (for Europe). However after having read that directive in more detail I do not think that this is a good idea.
Then my second thought was to use the ambiguity of 5.3.5.1. One possible way would be the following:
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Change the §5.3.5.1 to read:
In case of a vehicle combination comprising two vehicles the maximum towable mass shall be determined using the formulae of §§2.10.x and §§2.11.x as appropriate. Demand values, i.e. D, Dc and V, calculated using these formulae applying the maximum permissible towing vehicle, trailer and combination masses. These calculated demand values shall be lower than the corresponding characteristic value of the coupling equipment installed on the vehicle approved.

Add a new §5.3.5.2 to read:

In case of a vehicle combination comprising more two vehicles (modular combinations) the maximum towable mass shall be determined using the formulae given in §5.3.5.3 below as appropriate. Five different combinations are recognized:

1. Truck + Dolly + Semi-trailer
2. Tractor + Semi-trailer + Center-axle-trailer
3. Tractor + Semi-trailer + Dolly + Semi-trailer
4. Truck + Center-axle-trailer + Center-axle-trailer
5. Tractor + Link-trailer + Semi-trailer (B-Train)

The demand values, i.e. D, Dc and V, calculated using the formulae of §5.3.5.3 as appropriate shall be lower than the corresponding characteristic value of the coupling equipment installed on the vehicle approved.

Add a new §5.3.5.3 to read:
When calculating the demand values for modular combinations of §5.3.5.2 the following formulae apply. Note that the Center axle trailer coupling maximum support load, S_{max} = 1000 kg, is assumed.

Combination 1:

Step 1: Evaluate parameter A and B

Couplings	A =	B =	
Drawbar Coupling	T	$C_d + R_b$	A; B =>
Fifth wheel Dolly	$T + W_d$	$U_d + R_b$	A; B =>

Step 2: Calculate D and V using A and B

D^{**}	V^{*}
$D = g\, \dfrac{AB}{A+B}$	$V = Max(\dfrac{54}{L}; 5\dfrac{C_d}{L})$
$D = 0.5g\, \dfrac{A(B+0.08A)}{A+B-U_d}$	N/A

* Applicable to dollies with a rigid drawbar.
** For Dollies with a rigid drawbar the characteristic D_c shall exceed this calculated D-value.

Combination 2:

Step 1: Evaluate parameter A and B

Couplings	A =	B =	
Drawbar Coupling	$T + R_b$	C	A; B =>
5th wheel Tractor	T	$U_T + R_b + C$	A; B =>

Step 2: Calculate D and V using A and B

$D^{\dagger}$	V
$D = 0.65g\, \dfrac{AB}{A+B}$	$V = a\, \dfrac{X^2}{L^2} C$
$D = 0.5g\, \dfrac{B(A+0.08B)}{A+B-U_T}$	N/A

† The characteristic D_c of the drawbar coupling equipment shall exceed this calculated D-value.

Combination 3:

Step 1: Evaluate parameter A and B

Couplings	A =	B =	
Drawbar Coupling	$T + R_{1b}$	$C_d + R_{2b}$	A; B =>
5th wheel Dolly	$T + R_{1b} + W_d$	$U_d + R_{2b}$	
5th wheel Tractor	T	$U_T + R_{1b} + C_d + R_{2b}$	A; B =>
Required 5th wheel Coupling			

Step 2: Calculate D and V using A and B

D^{**}	V^{*}
$D = 0.65g\, \dfrac{AB}{A+B}$	$V = Max(\dfrac{54}{L}; 5\dfrac{C_d}{L})$
$D_1 = 0.5g\, \dfrac{A(B+0.08A)}{A+B-U_d}$	N/A
$D_2 = 0.5g\, \dfrac{B(A+0.08B)}{A+B-U_T}$	N/A
$Max(D_1; D_2)$	N/A

Combination 4:

Step 1: Evaluate parameter A and B

Couplings	A =	B =
1st Drawbar Coupling	T	$C_1 + C_2$
2nd Drawbar Coupling	$T + C_1$	C_2
Required Drawbar Coupling		

A; B =>

Step 2: Calculate D and V using A and B

D†	V
$D_1 = 0.9g\,\dfrac{AB}{A+B}$	$V_1 = \sqrt{\left(a\dfrac{X_1^2}{L_1^2}C_1\right)^2 + \left(\dfrac{t_1^2}{L_1^2}V_2\right)^2}$
$\left[D_2 = 0.65g\,\dfrac{AB}{A+B}\right]$	$V_2 = a\dfrac{X_2^2}{L_2^2}C_2$
D_1	V_1

† The characteristic D_c of the drawbar coupling equipment shall exceed this calculated D-value.

Combination 5:

Step 1: Evaluate parameter A and B

Couplings	A =	B =
Fifth wheel B-train	T	$U_T + R_{1b} + R_{2b}$

A; B =>

Step 2: Calculate D and V using A and B

D	V
$D = 0.5g\,\dfrac{B(A+0.08B)}{A+B-U_T}$	N/A

Symbols and definitions used in §5.3.5.2 and §5.3.5.3 that is not defined elsewhere in this regulation.

Dolly =   Towed vehicle with one axle group or single axle, and a fifth wheel coupling, designed to be combined with a semi-trailer. The drawbar of a converter dolly may be rigid or hinged.

Truck =   Motor vehicle built to tow a full trailer or a center axle trailer.

Tractor =   Motor vehicle built to tow a semi-trailer.

Link-trailer =   A semi-trailer with a fifth wheel mounted at the rear, such that a semi-trailer could be towed by the link-trailer

U_T, U_d, U_b =   The mass, in tonnes, imposed vertically on the fifth wheel (of a tractor (U_T), a dolly(U_d) or a B-trailer (U_b) by the semi-trailer loaded to its maximum total design mass.

W_d =   The tare mass, in tonnes, of a dolly.

R_b, R_{1b}, R_{2b} =   The mass, in tonnes, transmitted to the ground by the axle(s) of the semi-trailer loaded to its maximum total design mass. (Indices 1 and 2 indicating trailer 1 and 2 in the combination)

C_d =   The mass, in tonnes, transmitted to the ground by the axle(s) of the dolly including U_d.

L, L_1, L_2 =   Theoretical drawbar length, in meters, i.e. the distance between the centre of the drawbar eye and the centre of the axle assembly of the center axle trailer. (Indices 1 and 2 indicating trailer 1 and 2 in the combination)

X, X_1, X_2 =   Length, in meters, of the loading area of the center axle trailer.

t_1, t_2 =   Distance, in meter, from the center of axles of a center axle trailer to its rear coupling point.

A, B =   Parameters used in the calculations. "A" is the total mass forward of the coupling point. "B" is the total mass aft of the coupling point.

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Having done this in regulation 55, the challenge is to decide what need for Europe to be done with the information document according to 2007/46/EU Annex 2 with respect to towable mass. From the perspective of our working group we may leave all as is. Then it is a matter for the European commission to account for this once the application of European Modular Combinations are more common. With the above amendments to the regulation 55 we have given guidance to the national authorities how to proceed by Individual Vehicle approvals.

What is your opinion? Is this a possible way to pursue the handling of item 21 in our list? Could I distribute this to the experts of the working group?

Best regards

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