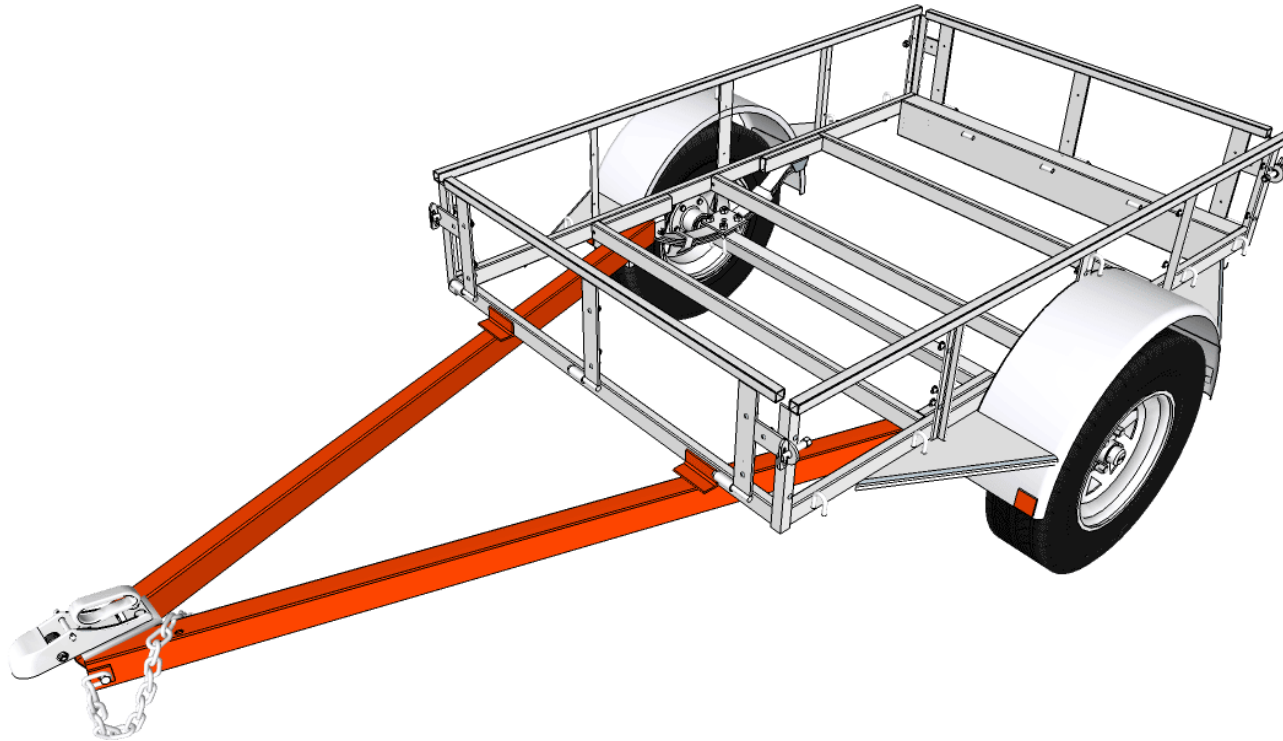




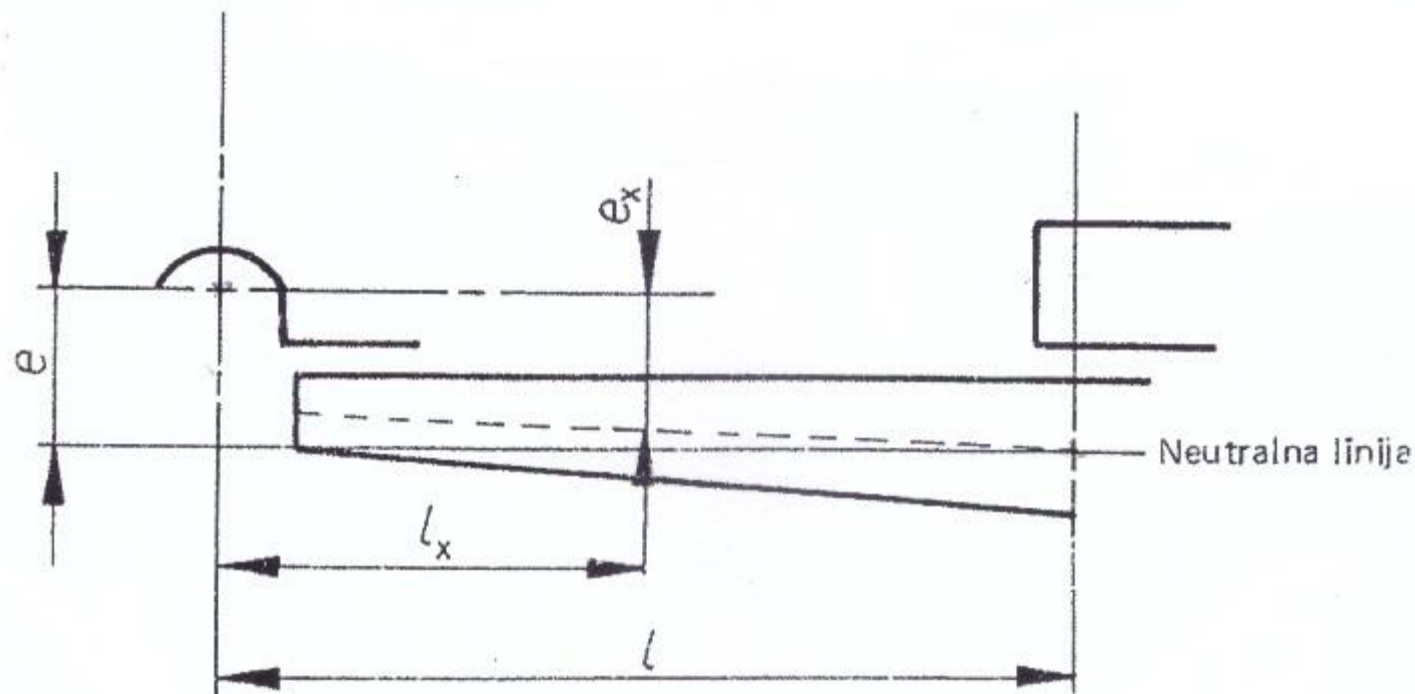
Провера механичке чврстоће руда прикључних возила



Бранислав Ђорђевић

Потребни подаци за израду прорачуна:

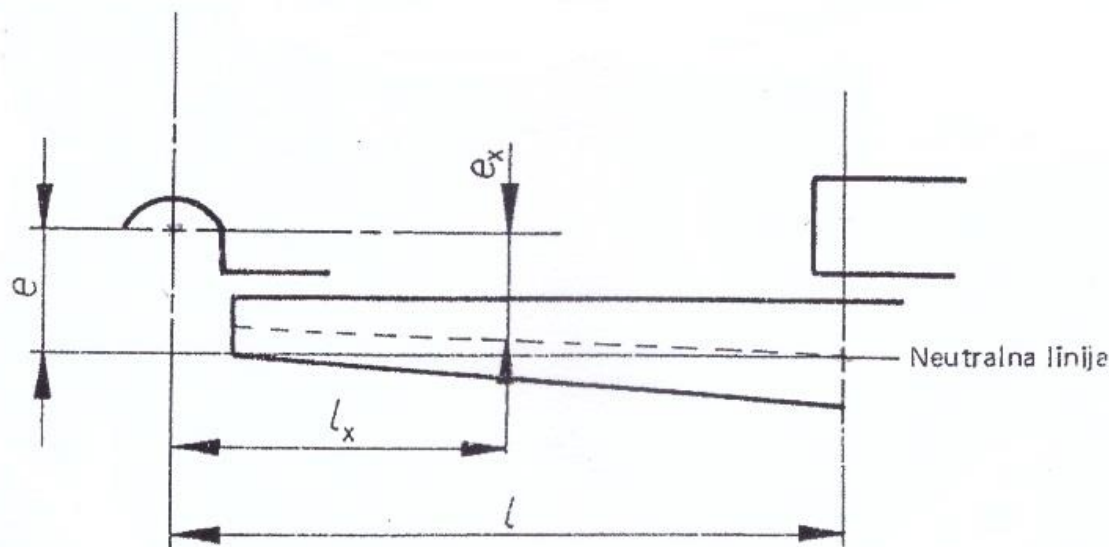
- карактеристике попречног пресека челичног профила
- геометријске карактеристике руде
- маса прикључног возила



Четири критеријума за добијање момента савијања:

- однос e/I мањи/већи од 0,15 (коефицијент k)
- руде дужине краће/дуже од 2,5 метара
- руде за приколице које имају/ немају кочни систем
- руде које су/нису изведене заваривањем

$$D = \frac{32000 * P}{32000 + P} * g$$



- Дозвољени напон:
- -руде које нису изведене заваривањем:

$$0.6 * R_{B\min} \geq R_c \leq 0.8 * R_S$$

- -руде које су изведене заваривањем:

$$0.45 * R_{B\min} \geq R_c \leq 0.65 * R_S$$

- R_c -дозвољени напон
- R_B -затезна чврстоћа
- R_S -напон течења

ПРОРАЧУН МЕХАНИЧКЕ ЧВРСТОЋЕ РУДА

l – растојање од вертикалне осе шапе до најближе тачке причвршћења руде на рам приколице
 k – растојање од вертикалне осе шапе до пресека руде који одговара максималном напонском стању
 e – растојање од хоризонталне осе шапе до неутралне линије у најближој тачки фиксирања руде на рам приколице
 e_x – растојање од хоризонталне осе шапе до неутралне линије руде у пресеку који одговара максималном напонском стању
 P – највећа укупна маса по декларацији произвођачке плочице
 D – вредност рачунски одређена за подужне силе које се јављају између вучног возила и приколице

l	k	e	e _x	P	D		R _s - дозвољени напон	R _a - напон течења	235000000
1.7	1.7	0.01	0.01	3500	30950		R _s - затезна чврстоћа	3.4E+08 / N - отпорни момент у критичном пресеку	0.000271

Највећи момент савијања за руде са $e/l < 0.15$ и $e_x/k < 0.15$

Руде дужине 2.5 m или мање		за руде дуже од 2.5 m; $k = 1.25 - 0.1 \cdot l$, за $k_{min} = 0.6$			1249.83
M _{za} приколице са кочницама:	21013	e / l	0.0059	e _x / k	0.0058824
M _{za} приколице без кочница:	14009				
Руде дужине веће од 2.5 m					
M _{za} приколице са кочницама:	3E+07				
M _{za} приколице без кочница:	2E+07				

Највећи момент савијања за руде са $e/l > 0.15$ и $e_x/k > 0.15$ израчунавају се три момента савијања, и највећа вредност се узима за рачунање највећег напона

Руде дужине 2.5 m или мање	
приколице са кочницама:	
M _f	35022
M _o	247.6
M _x	26452
приколице без кочница:	
M _f	14009
M _o	309.5
M _x	10739
Руде дужине веће од 2.5 m	
приколице са кочницама:	
M _f	3E+07
M _o	247.6
M _x	2E+07
приколице без кочница:	
M _f	2E+07
M _o	309.5
M _x	1E+07

Дозвољени напон (израчунава се за целу дужину руде, и не сме да пређе дозвољени напон R_s)

$$R = M_f / 2W_x$$

Руде које нису изведене заваривањем		
$0.6 R_{smin} \geq$	R _s	$\leq 0.8 R_s$
204	38.76940959	188

Руде које су изведене као заварене		
$0.45 R_{smin} \geq$	R _s	$\leq 0.65 R_s$
153000000	38.76940959	152750000



Na osnovu zahteva proizvođača uređaja, zahteva UN/ECE Pravilnika R55 i EEC Direktive 94/20 izvršeno je ispitivanje u cilju verifikacije sekundarnog priključnog uređaja za koji se izdaje:

POTVRDA

Broj: P-C4339/18

1. Podnosilac zahteva-proizvođač:

Naziv : "Radnja za proizvodnju uređaja za dizanje i prenošenje, bravarska delatnost i proizvodnja autoprikolica VIDIJA NIS"
Adresa : Živorada Kostića Moravca 17A, 18000 Niš
Država : Srbija

2. Naziv proizvoda:

VUČNI UREĐAJ-RUDA

3. Oznaka proizvoda prema proizvodnoj dokumentaciji / tip:

-

4. Proizvod je namenjen za:

Za vuču prikolice "VIDIJA" tipa VID sa centralnom osovinom kategorije O2, najveće dozvoljene mase $P=3500\text{ kg}$ ($D=D_c=30,95\text{ kN}$).

5. Tehničke karakteristike uređaja:

Podužni nosači rude su promenljivog poprečnog preseka.



Merođavni parametri	
$L_a=1-2,24\text{ m}$	
$a_a=a=0,0105\text{ m}$	
Materijal rude C.0561 (S355 J0)	
Maksimalni moment po nosaču: $M_{max}=27687,74\text{ Nm}$	
Dovoljni napon prema SRPS ISO 7641-1: $R_m=240\text{ MPa}$	
Napon u kritičnom preseku sa ojačanjima prema SRPS ISO 7641-1: $R_m=51,08\text{ MPa}$	

6. Vučni uređaj ruda proizvođača "Radnja za proizvodnju uređaja za dizanje i prenošenje, bravarska delatnost i proizvodnja autoprikolica VIDIJA NIS", pravilno ugrađen na priključno vozilo prema naznačenim deklariranim merođavnim parametrima, zadovoljava zahteve UN/ECE Pravilnika R55, EEC Direktive 94/20 i standarda SRPS ISO 7641-1 za bezbednu vuču prikolice komercijalne oznake "VIDIJA" tipa VID sa centralnom osovinom (kategorije O2) sa najvećom dozvoljenom masom 3500 kg.

Potvrda je izdata u 4 (četiri) primerka, od kojih su dva originala predata podnosiocu zahteva.

U Beogradu, dana 05.06.2018. god.

Rukovodilac
Laboratorije CIAH

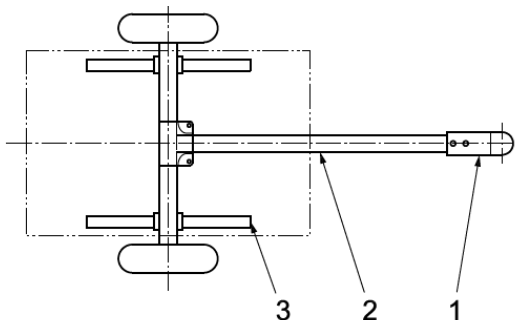
M.P.

Prodekan za
naučno-istraživačku delatnost

Prof. dr Vladimir Popović

Prof. dr Dragoslava Stojiljković

Примери решења

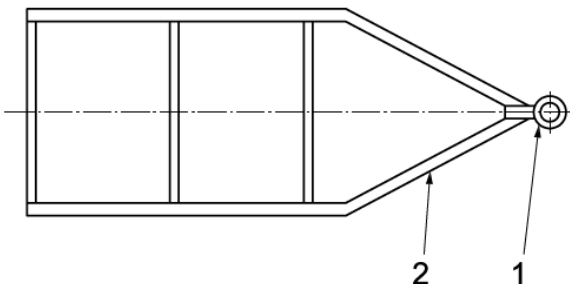


Key

- 1 coupling head
- 2 drawbar
- 3 chassis

NOTE Drawbar is a separate technical unit. Devices for height adjustments can be provided.

Figure A.1 — Drawbar as a separate technical unit

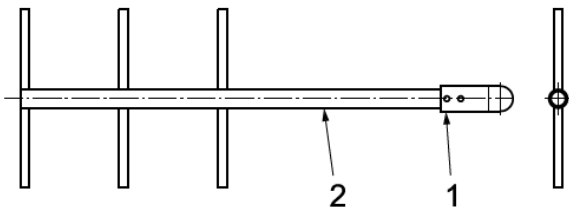


Key

- 1 drawbar eye
- 2 chassis

NOTE Integral chassis-drawbar manufactured by bending, cutting in and welding. Trailer manufacturer's responsibility.

Figure A.2 — Integral chassis-drawbar

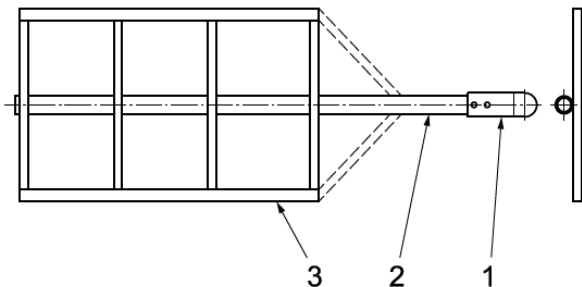


Key

- 1 coupling head
- 2 chassis

NOTE Drawbar is part of the frame; only the coupling head is a separate technical unit. Trailer manufacturer's responsibility.

Figure A.3 — Drawbar as part of the frame



Key

- 1 coupling head
- 2 drawbar
- 3 chassis

NOTE Drawbar is a separate technical unit from the beginning to the end.

Figure A.4 — Drawbar as a separate technical unit from beginning to end

Правилник R55 – Приколица са централном осовином

3.6. Drawbars

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 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:

$$F_{sp} = (g \times S/1000) + V$$

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



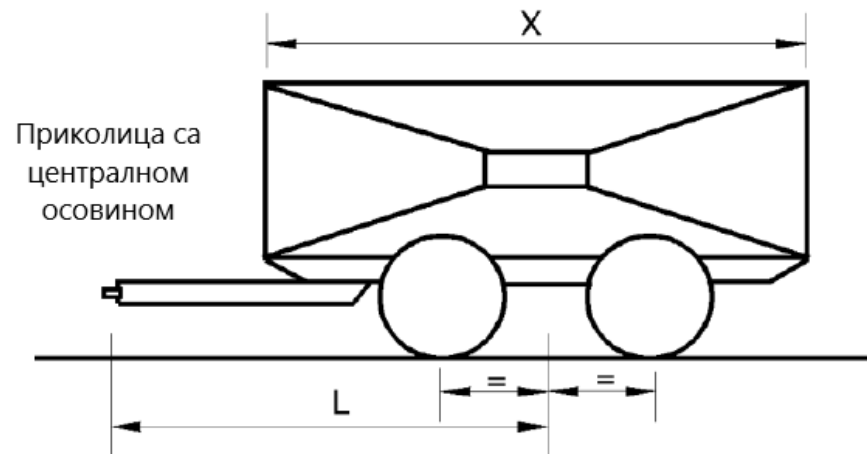
2.11.4. The V value is the theoretical reference value of the amplitude of the vertical force imposed on the coupling by the centre axle trailer of technically permissible maximum mass greater than 3.5 tonnes. The V value is used as the basis for vertical forces in the dynamic tests.

$$V = \frac{a \cdot C \cdot X^2}{L^2} \text{ [kN]} \quad (\text{See the note below})$$

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)



Правилник R55 – Вишеосовинска приколица

Режим I

3.6.2. For drawbars for full trailers with free movement in the vertical plane, in addition to the endurance test or theoretical verification of strength, the resistance to buckling shall be verified either by a theoretical calculation with a design force of $3.0 \times D$ or by a buckling test with a force of $3.0 \times D$. The permissible stresses in the case of calculation shall be in accordance with paragraph 5.3. of ISO 7641/1:1983.

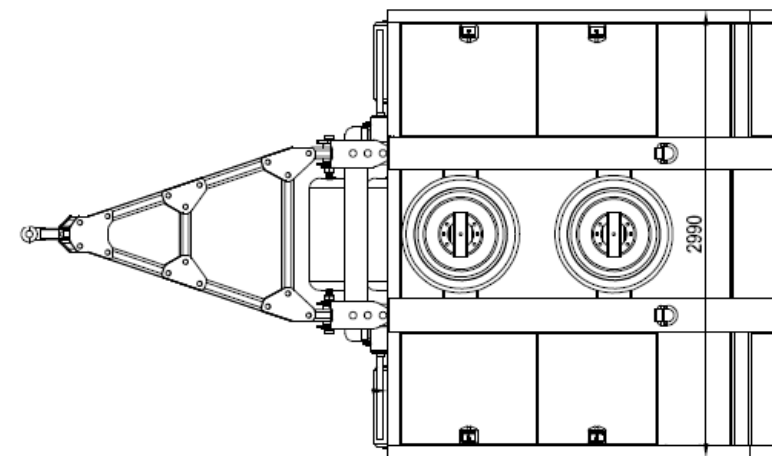
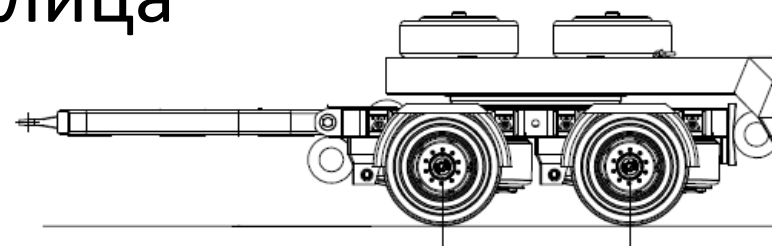
2.11.1. The D or Dc value is the theoretical reference value for the horizontal forces in the towing vehicle and the trailer and is used as the basis for horizontal loads in the dynamic tests.

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

$$D = g \frac{T \cdot R}{T + R} \text{ [kN]}$$

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

$$D_c = g \frac{T \cdot C}{T + C} \text{ [kN]}$$



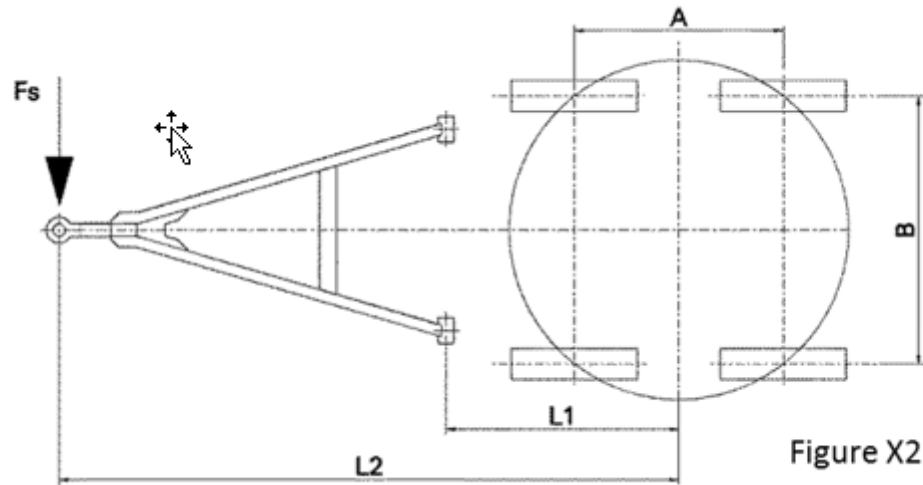
Режим II

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 $F_{hp} = 1.0 \times D$ shall be taken into consideration.

Правилник R55 – Вишеосовинска приколица

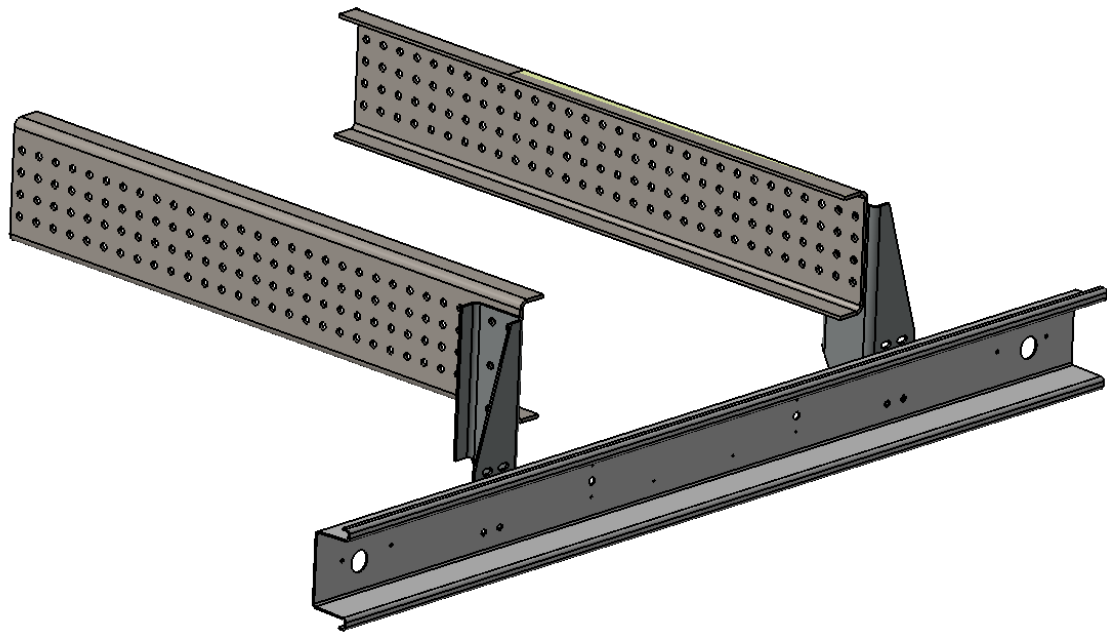
Режим III

3.6.3. In the case of steered axles, the resistance to bending shall be verified by theoretical calculations or by a bending test. A horizontal, lateral static force shall be applied in the centre of the coupling point. The magnitude of this force shall be chosen so that a moment of $0.6 \times A_v \times g$ (kNm) is exerted about the front axle centre. The permissible stresses shall be in accordance with paragraph 5.3. of ISO 7641/1:1983.





UN ECE-R58 – Уређаји против подлетања са задње стране



Правилник R58 – захтеви

2. General requirements

- 2.1. All vehicles shall be so constructed and/or equipped as to offer effective protection over their whole width against under-running of vehicles mentioned in paragraph 1. of this Regulation in the event of rear collision with vehicles of category M₁ and N₁.¹
- 2.2. The vehicle shall be tested under the conditions as laid down in paragraph 2. of Annex 5.
- 2.3. Any vehicle in one of the categories M₁, M₂, M₃, N₁, O₁ or O₂ shall be deemed to satisfy the condition set out above:
- (a) If it satisfies the same conditions as set out in Part II or Part III, or
 - (b) If the ground clearance of the rear part of the unladen vehicle does not exceed 550 mm over a width which is not shorter than that of the rear axle by more than 100 mm on either side (excluding any tyre bulging close to the ground), or
 - (c) If, in case of vehicles of categories O₁ and O₂ where the tyres project for more than half of their width outside the bodywork (excluding the

wheel guards) or outside the chassis in the absence of bodywork, the ground clearance of the rear part of the unladen vehicle does not exceed 550 mm over a width which is not less than 100 mm deducted from the distance measured between the innermost points of the tyres (excluding any tyre bulging close to the ground), on either side.

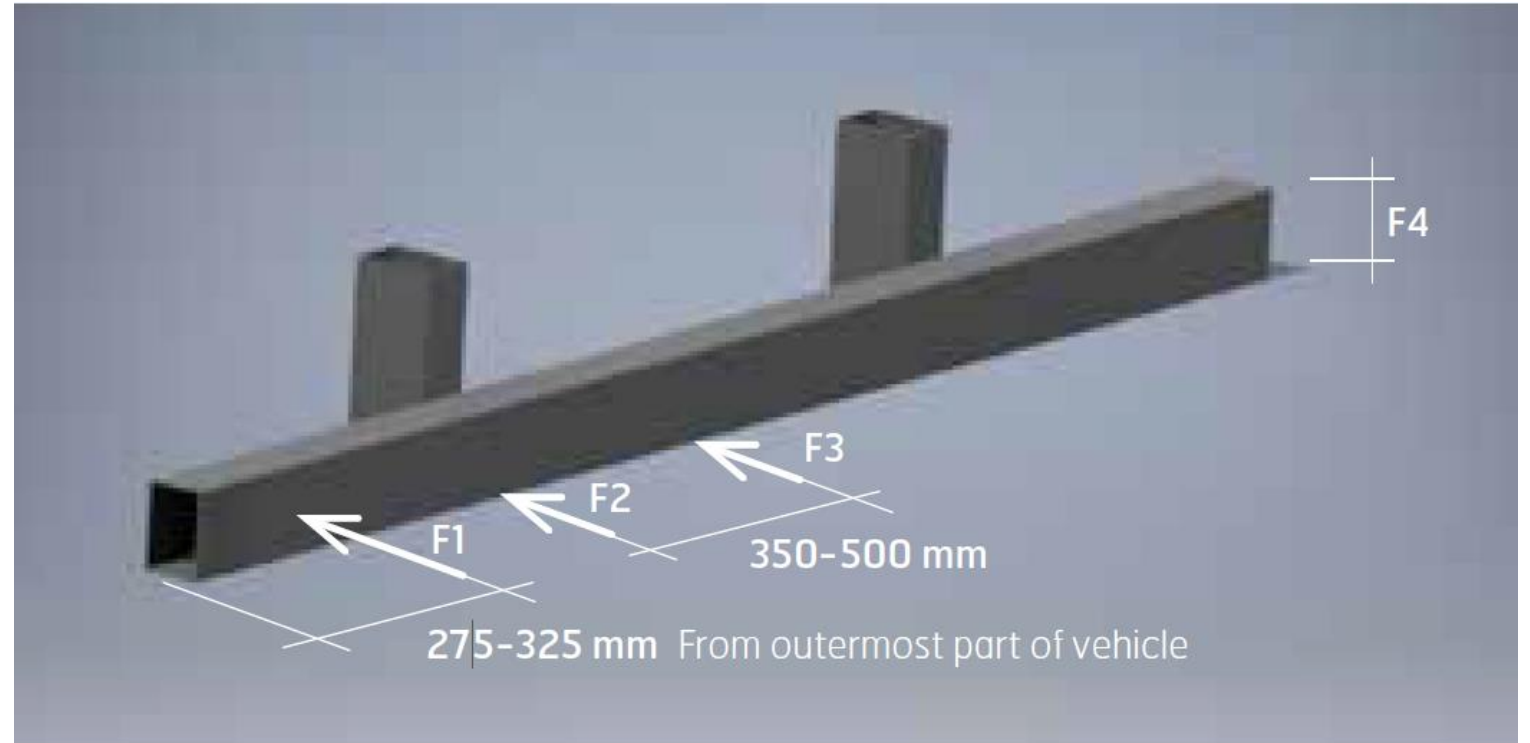
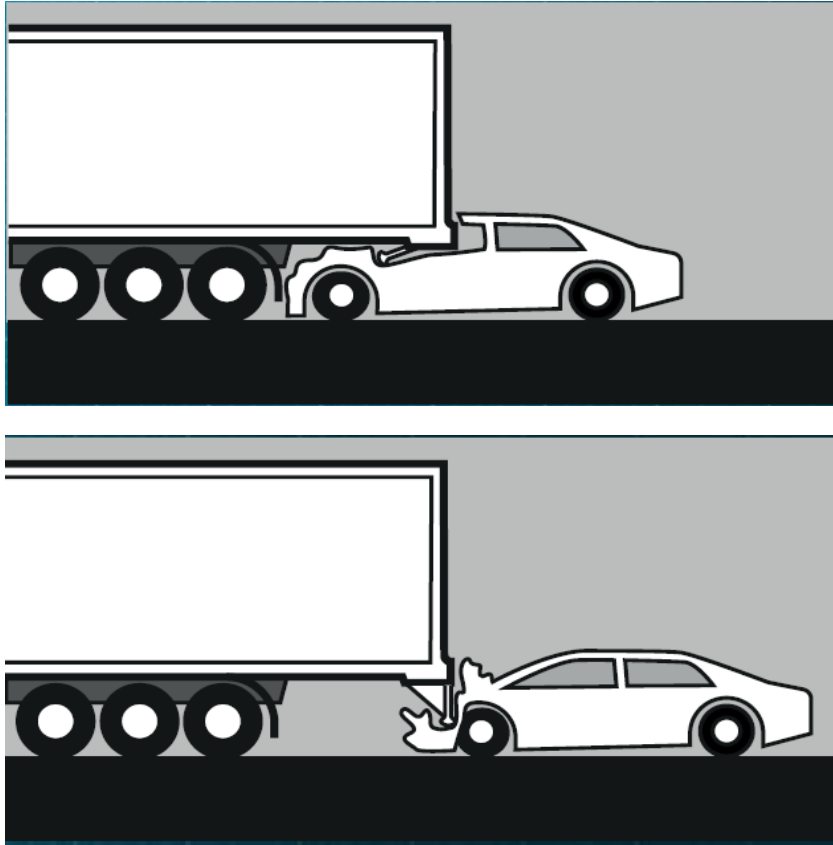
Where there is more than one rear axle, the width to be considered is that of the widest.

The requirements of paragraphs 2.3.(b) and 2.3.(c) above shall be satisfied at least on a line:

- (a) At a distance of not more than 450 mm from the rear extremity of the vehicle;
- (b) That may have interruptions totalling not more than 200 mm.

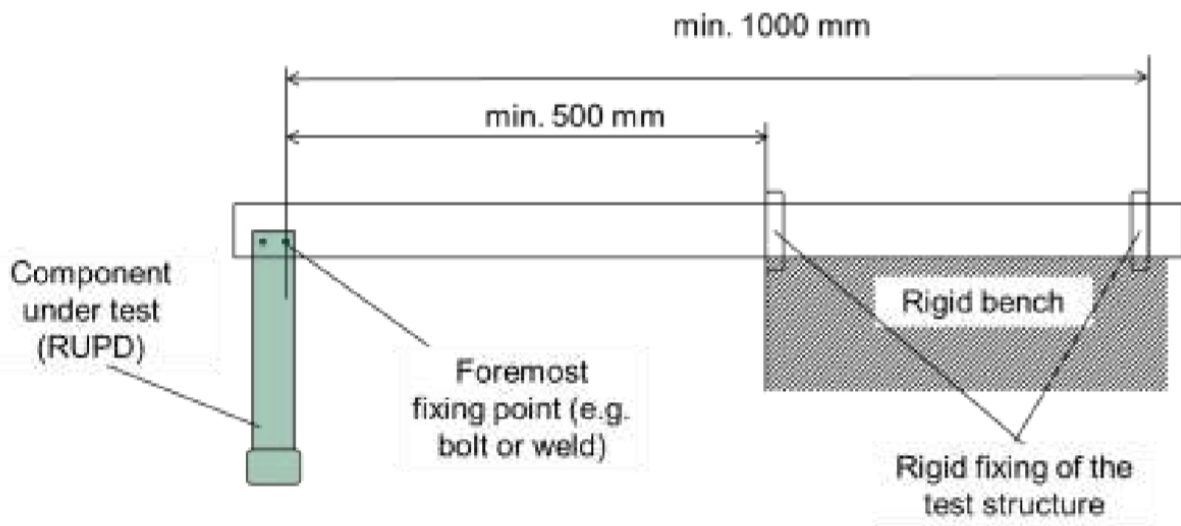


Правилник R58 – места деловања сила



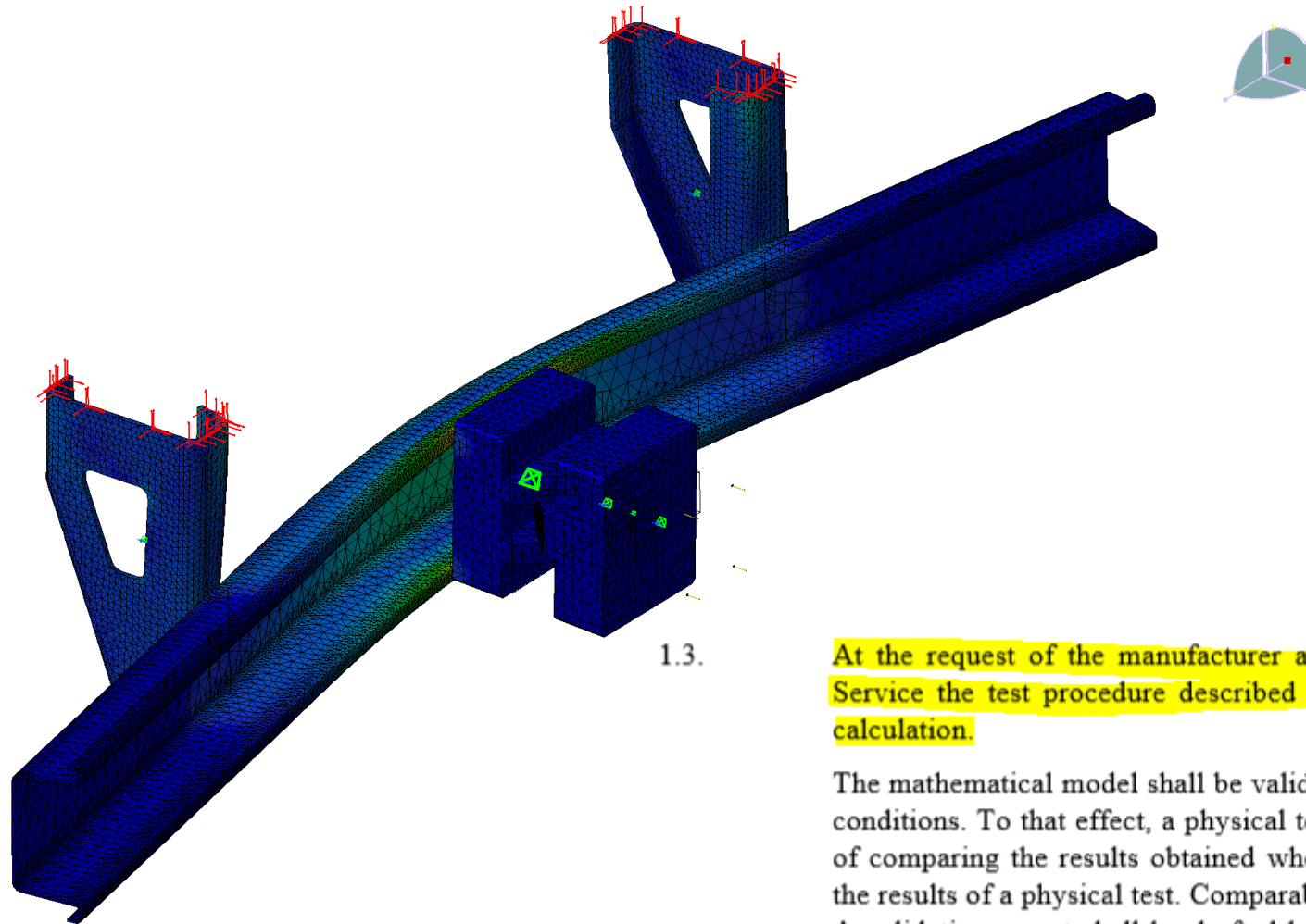
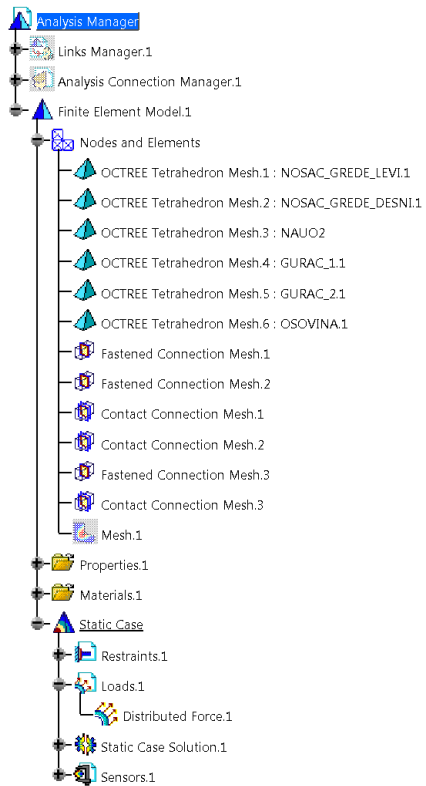
F1=100 kN; F2=180 kN; F3=100 kN

Правилник R58 – испытна платформа



1. Test conditions for RUPDs
 - 1.1. At the request of the manufacturer the test may be conducted either:
 - 1.1.1. On a vehicle of the type for which RUPD is intended; in this case the conditions set out in paragraph 2. below shall be observed; or
 - 1.1.2. On a part of the chassis of the vehicle type for which the RUPD is intended; this part shall be representative of the vehicle type(s) in question; or
 - 1.2. In the case of paragraph 1.1.2., the parts used to connect the RUPD to part of the vehicle chassis shall be equivalent to those which are used to secure the RUPD when it is installed on the vehicle. The part of the chassis can be fixed on a test bench as shown in Figure 1, representing the minimum requirements to be fulfilled. The structures used as side rails shall be representative of the chassis of vehicles for which the underrun protection system is intended.
- The distance of the foremost fixing point of the RUPD from the rigid test bench shall not be less than 500 mm. If a diagonal strut is used to support the RUPD, this distance shall be measured between the foremost fixing point of the strut to the side rail structures and the rigid test bench.

Правилник R58 – МКЕ



At the request of the manufacturer and with the consent of the Technical Service the test procedure described in paragraph 3. may be simulated by calculation.

The mathematical model shall be validated in comparison with the actual test conditions. To that effect, a physical test shall be conducted for the purposes of comparing the results obtained when using the mathematical model with the results of a physical test. Comparability of the test results shall be proven. A validation report shall be drafted by the manufacturer or by the technical service and submitted to the Type Approval Authority.

