

Summary strength and stability calculation

Modular Triangle Bridge (MTB) between rolling scaffolds

Combination Configurations MTB between rolling scaffolds
MTB length 2 – 12 m, platform height 2.2 – 12.2m

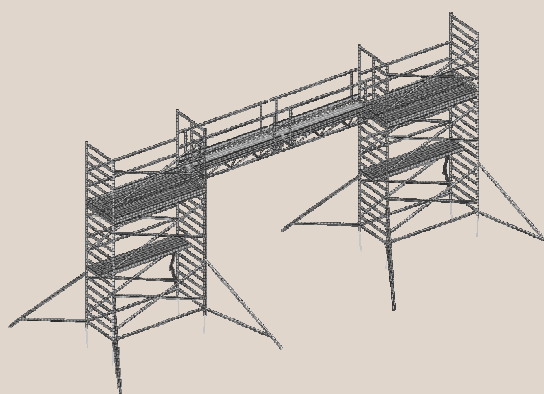


art.no. **488926-B-1309**

Declaration

Executed and calculated in accordance with applicable standard: **EN 1004**

In the Netherlands the Working at Height European Guideline is included in the Working Conditions Decree and is therefore compulsory. Based on this, when using scaffolding a strength and stability calculation has to be present at the work unless a Standard Configuration is used. Strength and stability calculations are also available from Altrex or through the Altrex dealers when new Standard Configurations are purchased, in accordance with the applicable standards (state of the art). For the Combination Configurations MTB between rolling scaffolds, this is the EN 1004 (Rolling scaffolds assembled from prefabricated parts – Materials, dimensions, loads, safety and performance requirements. This provides certainty when purchasing good work equipment.



Combination Configuration MTB between rolling scaffolds

For more information about current legislation regarding safe working at height please visit www.altrex.nl/veiligwerken or phone Altrex: + 31 38-4557777.

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Scope of this summary

Altrex possesses the necessary specialist knowledge to produce and analyse a strength and stability calculation for Standard Configurations, Combination Configurations and custom-built products. The output of a calculation is very comprehensive. For that reason, a summary of the calculation has been opted for. If required, the Health and Safety Inspectorate at Altrex can check the full very comprehensive calculation (results). The calculation is made using the Finite Element Method (FEM).

The Summary strength and stability calculation relates to Combination Configurations MTB between rolling scaffolds comprising an MTB (length 2 – 12 m) positioned between two freestanding rolling scaffolds (height 2.2 – 6.2 m), assembled and used as described in the Altrex manual.

Part A

Strength calculation

Prescribed in European standard EN 1004 is that a rolling scaffold has to be able to resist a combination of forces:

- Self weight of the Combination Configurations;
- Loads arising from a 1% tilt;
- Wind load on the entire Combination Configurations, $q_{wind} = 0.1 \text{ kN/m}^2$;
- Evenly distributed vertical load on the MTB floor (load class 2), $q_{distr, class 2} = 1.5 \text{ kN/m}^2$;
on working platform rolling scaffold (load class 3), $q_{distr, class 3} = 2.0 \text{ kN/m}^2$;
- horizontal load (on working platform level) on MTB, $F_{hor} = 0.3 \text{ kN}$;
on rolling tower, $F_{hor} = 0.3 \text{ kN}$.

FEM models were produced for the calculations from Combination Configurations with an equal MTB length ($l = 4, 6, 8, 10$ and 12 m) positioned between 2 rolling scaffolds with a platform height varying from $h = 2.2 \text{ m}$ up to and including $h = 6.2 \text{ m}$. Combinations of the aforementioned forces are applied to the calculation models in both horizontal longitudinal and transverse directions. The evenly distributed vertical load and the horizontal load are assumed to strike at the same time at the same section of the configuration: on the MTB or on one of the rolling scaffolds. Also applicable is the additional requirement that the total vertical load in the entire Combination Configuration may not exceed 750 kg .

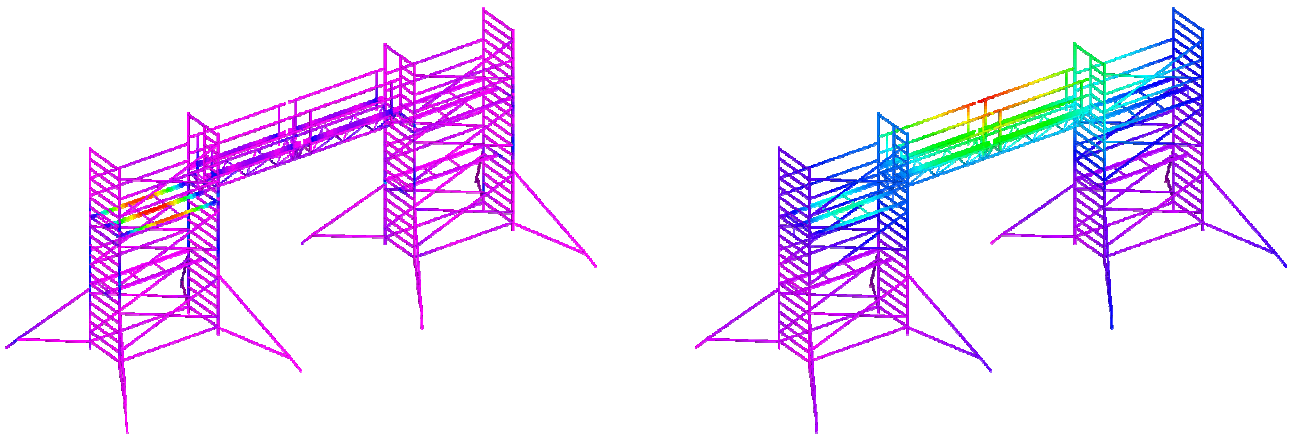


Figure 1: Illustration of the calculated stresses and deformations

Conclusion of the strength calculation

The Combination Configurations MTB between rolling scaffolds comply with the strength requirements as described in European standard EN 1004. The strength calculations do not show any inadmissible high stresses and the distortions also remain within the limits. The condition is that the configuration is assembled and used as described in the Altrex manual and taking into account the conditions for use described in part C.

Part B

Stability calculation

European standard EN 1004 states that in addition to positional stability (tipping), the resistance against being blown or displacement of the Combination Configurations MTB between rolling scaffolds has to be checked. Calculations are performed using combinations of the following forces:

- self weight of the Combination Configuration;
- forces arising from a 1% tilt;
- wind load on the entire Combination Configuration, $q_{wind} = 0,1 \text{ kN/m}^2$;
- horizontal load (at floor height) on MTB, $F_{hor, MTB} = 0,3 \text{ kN}$;
on rolling scaffold, $F_{hor, RS} = 0,3 \text{ kN}$.

It has to be calculated whether the stability of the Combination Configurations under the influence of the potential combinations of forces complies with the standard for both the situation when in use (safety factor = 1.5) and the situation when not in use (parking situation, safety factor = 1.3)

Part B (continued)

Both rolling scaffolds stand on four wheels and all the way around are equipped with triangular stabilisers which rest on the ground (figure 2, ▲). From the calculated reaction forces at the wheels and the triangular stabilisers, it can be deduced whether the Combination Configuration complies with the stability requirements of EN 1004. When the reaction forces are negative (i.e. tensile forces), the relevant support is removed in the calculation model and the calculation is carried out again. If necessary, counterweight can be included in the model.

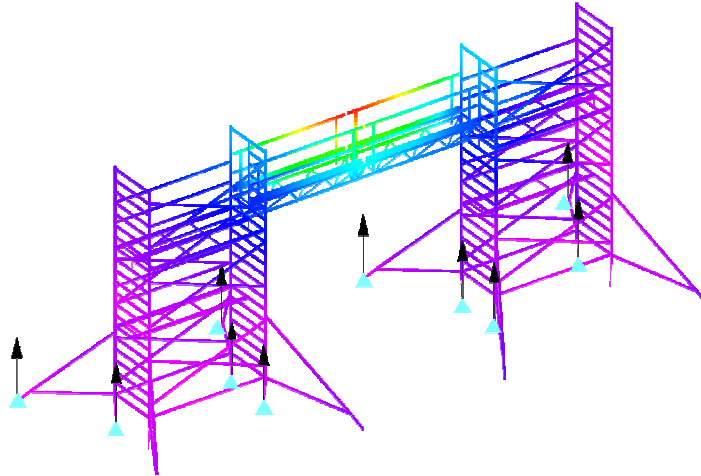


Figure 2: Example of calculated reaction forces on Combination Configuration MTB between rolling scaffolds

Conclusion of the Stability

The Combination Configurations *MTB between rolling scaffolds* comply with the stability requirements in accordance with European standard EN 1004. The condition is that the MTB is assembled and used in accordance with the Altrex manual and taking into account the conditions for use described in part C.

Part C

Conditions for use

Just like for Standard Configurations, counterweight is required for a number of Combination Configurations *MTB between rolling scaffolds* for the stability. In addition, for a number of the calculated configurations a reduction of the vertical load has been found to be needed in order to guarantee the strength and stability of the configuration. In table I, an overview is provided for the calculated Combination Configurations of the number of 20-kg counterweights required for each rolling scaffold and the maximum admissible vertical load on the scaffold or on the MTB, where the total vertical load in the entire Combination Configuration may not exceed 750 kg (see part A).

The Combination Configurations that fall within the shaded section of the overview do not comply with EN 1004; anchorage is required for stability, because of which the configuration falls under European standard EN 12811.

			Length MTB										
			04m	05m	06m	07m	08m	09m	10m	11m	12m		
Platform height rolling towers	2.2m	# 20kg CW's/tower	0	0	0	0	0	0	0	3	3		
		vertical load	MTB	1,5 kN/m ²	1,5 kN/m ²	1,5 kN/m ²	max. 750kg	max. 750kg	max. 550kg	max. 550kg	max. 350kg	max. 350kg	
			tower	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	
	4.2m	# 20kg CW's/tower	0	0	0	1	1	1	1	<div></div>			
		vertical load	MTB	1,5 kN/m ²	1,5 kN/m ²	1,5 kN/m ²	max. 750kg	max. 750kg	max. 550kg				max. 550kg
			tower	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²				2,0 kN/m ²
	6.2m	# 20kg CW's/tower	4	5	5	8	8	<div></div>					
		vertical load	MTB	1,5 kN/m ²	1,5 kN/m ²	1,5 kN/m ²	max. 750kg						max. 750kg
			tower	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²	2,0 kN/m ²						2,0 kN/m ²
		remarks	-	-	-	-	-						
			<div></div>					<div></div>			<div></div> <div>anchorage required</div>		
			<div></div>										

Table I: Overview of usage loads and counterweight (CW)

Part C (continued)

Configuration assembly

The Summary strength and stability calculation *MTB between rolling scaffolds* applies to Combination Configurations comprising an MTB (length 2 – 12 m) positioned between two freestanding rolling scaffolds, assembled and used as described in the Altrex manual and with the parts listed in the manual, shown in table 2.

Length MTB (m)			2,00	3,00	4,00	5,00	6,00	7,00	8,00	9,00	10,00	11,00	12,00
Description	Art.nr.	Weight (kg)											
MTB	Truss MTB 2m (L = 211,3 cm)	331502	11,7	1		1							
	Truss MTB 3m (L = 295,5 cm)	331503	15,1	1		1	2	1		3	2	1	
	Truss MTB 4m (L = 421,8 cm)	331504	20,3		1			1	2		1	2	3
	Deck MTB 2m (wood)	331512	11,0	1	2	1		2	4		2	4	6
	Deck MTB 3m (wood)	331513	15,7		1	1	2	1		3	2	1	
	Guardrailframe 2 m MTB	331522	6,4	1		1							
	Guardrailframe 3 m MTB	331523	8,4		1	1	2	1					
	Guardrailframe 4 m MTB	331524	12,2		1			1		3	2	1	
	Truss coupling set complete MTB	331580	0,3		1				2		1	2	3
	Adapter TB - RS left	331540	0,4	2	2	2	2	2	2	2	2	2	2
	Adapter TB - RS right	331541	0,4	2	2	2	2	2	2	2	2	2	2
Total weight (kg)			30,7	40,8	56,4	69,9	80,0	95,3	110,6	119,2	134,5	149,8	165,1

Platform height (m)			2,20	4,20	6,20
Working height (m)			4,20	6,20	8,20
Description	Art.nr.	Weight (kg)			
Frame PROF 135-28-7	301607	11,0	6	8	10
Frame PROF 135-28 walkthrough	307008	10,2	2	2	2
Wheelleg + wheel Ø 200 mm PROF	511230	5,2	8	8	8
Wooden platform PROF 185 m with trapdoor	304410	14,8			
Wooden platform PROF 245 m with trapdoor	304510	18,7	1	1	2
Wooden platform PROF 305 m with trapdoor	304610	23,6			
Wooden platform PROF 185 m without trapdoor	304420	14,4			
Wooden platform PROF 245 m without trapdoor	304520	18,4	1	1	2
Wooden platform PROF 305 m without trapdoor	304620	23,3			
Diagonal brace PROF 185-21	303721	1,9			
Diagonal brace PROF 245-28-6	303716	2,3	10	18	26
Diagonal brace PROF 305-22	303722	2,6			
Horizontal brace PROF 185-4	303704	1,8			
Horizontal brace PROF 245-6	303706	2,2	12	12	20
Horizontal brace PROF 305-8	303708	2,6			
Triangular stabilizer PROF Easy-Lock® Universal	305613	8,0	8	8	8
Head toeboard PROF set 2 / 1.35 Easy-Lock®	305596	5,0	2	2	2
Toeboard set PROF 2/1.85 Easy-Lock®	305591	6,0			
Toeboard set PROF 2/2.45 Easy-Lock®	305592	8,0	2	2	2
Toeboard set PROF 2/3.05 Easy-Lock®	305593	9,5			
Total weight (kg)					
2 x rolling tower (length 1,85m)			283,8	321,0	401,8
(length 2,45m)			304,5	344,9	440,0
(length 3,05m)			325,1	367,9	478,4

Table 2: List of parts for Combination Configurations MTB between rolling scaffolds

Part D

Conclusion

In this strength and stability calculation summary, Altrex declares that provided that the Combination Configurations *MTB between rolling scaffolds* are assembled and used in accordance with the Altrex manual, it complies with the requirements laid down in European standard EN 1004 (*Rolling Scaffolds assembled from prefabricated parts – Materials, dimensions, loads, safety and performance requirements*).

The Combination Configuration MTB between rolling scaffolds complies with the strength requirements: YES

The Combination Configuration MTB between rolling scaffolds complies with the stability requirements: YES