

SPANer

assistance in the selection of profiled sheets offered by
ArcelorMittal Construction.

RESULTS OF THE CALCULATION

ArcelorMittal



SPANer – RESULTS OF THE CALCULATION

Once we have gone through all the stages of the 'First Steps' presentation and calculation, we can go on to discuss the results. Of course, they will differ significantly in each case as to the value or number of results, but the pattern remains the same. For the purposes of the discussion, we will use the results for the data filled in as shown in the screenshot below.

Input data

No of spans: 3

Support: Both supports

Producer: Polska

f_{yb} = 320 [MPa]

Profile sheet: Hacierco 136/337

t = 0.75 - 8.74 [mm]

The extend of using the profile

ULS: 87 [%]

Fire: RE 15

Limit of deflection

a_{lim} = l / 150

Support width

Internal support: 60 [mm]

End support: 40 [mm]

Normal force

N = 5 [kN/m]

Safety factors

Dead weight, γ_f = 1.35 ψ = 0.85 Partial fact, γ_M = 1.00

Data to be printed

main roof

axis 4-5

Wind zone: I Terrain category: II

A, [m]: 120 h, [m]: 12.40 Snow zone: II

Cross-section

Static schema

0.75 - 8.74 [kg/m²] 0.75 - 8.74 [kg/m²] 0.75 - 8.74 [kg/m²]

L = 1.75 [m] L = 6.00 [m] L = 6.00 [m] L = 6.00 [m] L = 1.75 [m]

Add load +

Number	Load description	Category	γ _f	ψ	Span number	q1 [kN/m ²]	q2 [kN/m ²]	x1 [m]	x2 [m]
1	Warstwy (membrana, wełna mineralna gr.15cm)	Permanent	1.35	0.85	wszystkie	0.27	0.27	0.00	21.50
2	instalations	Live	1.50	1.00	wszystkie	0.50	0.50	0	21.5
3	wind	Wind	1.50	0.60	wszystkie	0.14	0.14	0	21.5
4	snow	Snow	1.50	1.00	wszystkie	0.72	0.72	0	21.5
5	other snow	Snow	1.50	1.00	LEFT	1.08	0.70	0.00	1.75
6	other snow	Snow	1.50	1.00	1	0.70	0.00	0.00	3.25

CALCULATE

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Dimensioning

Here we can find practically all the results we need.

The table summarises the results of the static calculations in each span. For each span, the range, the values of the shear forces at the beginning and end of the system, the values of the moments at the 3 locations and the value of the deflection are given.

The next table defines the value of the reaction. Using different layouts and extensions influences the reaction value at the support. By looking at the reaction values, it is easy to assess whether the designed layout does not, for example, influence the load capacity of the girders to be exceeded.

DESIGN LOAD SCHEMA MOMENTS GRAPH VERTICAL SHEAR GRAPH DEFLECTION GRAPH PROJECTS PRINT TO DOC

Span	L [m]	V _{Ed} max [kN/m]		M _{Ed} max [kNm/m]			Deflection [mm]
		x = 0	x = L	Prop	Span	Prop	
left	1.75	0.00	-6.48	0.00	-5.81	-5.81	-1.66
1	6.00	7.99	-7.91	-5.81	4.38	-8.84	13.08
2	6.00	7.43	-6.77	-8.84	2.82	-6.86	5.56
3	6.00	7.91	-6.89	-6.86	5.83	-3.78	10.89
right	1.75	4.32	0.00	-3.78	-3.78	0.00	-6.60

Prop	1	2	3	4
R _{Ed} [kN/m]	14.47	15.34	14.68	11.20

ULS

Sagging bending resistance (39%)
 Span 1: $M_{Ed}^+ / M_{c,Rd}^+ = 4.38 / 11.12 = 0.39 < 1.00$
 Span 2: $M_{Ed}^+ / M_{c,Rd}^+ = 2.82 / 11.12 = 0.25 < 1.00$
 Span 3: $M_{Ed}^+ / M_{c,Rd}^+ = 5.83 / 22.24 = 0.26 < 1.00$

Hogging bending resistance (64%)
 Prop 1: $M_{Ed}^- / M_{c,Rd}^- = 5.81 / 10.73 = 0.54 < 1.00$
 Prop 2: $M_{Ed}^- / M_{c,Rd}^- = 8.84 / 21.46 = 0.41 < 1.00$
 Prop 3: $M_{Ed}^- / M_{c,Rd}^- = 6.86 / 10.73 = 0.64 < 1.00$
 Prop 4: $M_{Ed}^- / M_{c,Rd}^- = 3.78 / 21.46 = 0.18 < 1.00$

Pressure to the support resistance (73%)
 Prop 1: $R_{Ed,b} / R_{w,Rd,b} = 14.47 / 20.00 = 0.72 < 1.00$
 Prop 2: $R_{Ed,b} / R_{w,Rd,b} = 15.34 / 40.00 = 0.38 < 1.00$
 Prop 3: $R_{Ed,b} / R_{w,Rd,b} = 14.68 / 20.00 = 0.73 < 1.00$
 Prop 4: $R_{Ed,b} / R_{w,Rd,b} = 11.20 / 40.00 = 0.28 < 1.00$

Interaction on the internal support (108%)
 Prop 1: $M_{Ed,red}^+ / M_{0,Rd}^+ + R_{Ed,b}^- / R_{0,Rd,b} = 5.62 / 13.42 + 14.47 / 25.00 = 1.00 < 1.00$
 Prop 2: $M_{Ed,red}^+ / M_{0,Rd}^+ + R_{Ed,b}^- / R_{0,Rd,b} = 8.62 / 26.84 + 15.34 / 50.00 = 0.63 < 1.00$
 Prop 3: $M_{Ed,red}^+ / M_{0,Rd}^+ + R_{Ed,b}^- / R_{0,Rd,b} = 6.66 / 13.42 + 14.68 / 25.00 = 1.08 > 1.00$
 Prop 4: $M_{Ed,red}^+ / M_{0,Rd}^+ + R_{Ed,b}^- / R_{0,Rd,b} = 3.65 / 26.84 + 11.20 / 50.00 = 0.36 < 1.00$

Vertical shear resistance at the beginning and end of the overlapping (34%)
 Prop 2 on the left side: $V_{Ed,b} / V_{w,Rd,b} = 6.49 / 19.28 = 0.34 < 1.0$
 Prop 2 on the right side: $V_{Ed,b} / V_{w,Rd,b} = 6.01 / 19.28 = 0.31 < 1.0$

Bending resistance at the beginning and end of the overlapping (45%)
 Prop 2 on the left side: $M_{Ed}^- / M_{c,Rd}^- = 4.52 / 10.73 = 0.42 < 1.0$
 Prop 2 on the right side: $M_{Ed}^- / M_{c,Rd}^- = 4.81 / 10.73 = 0.45 < 1.0$

Bending and compression resistance (67%)
 Prop 3: $M_{Ed}^- / M_{c,Rd}^- + N_{Ed} / N_{Rd} = 6.86 / 10.73 + 5.00 / 167.01 = 0.67 < 1.00$

The maximum strength for the Ultimate Limit State (ULS) is 108% and is not enough to fulfill the condition of the reduction of the extent of using the profile 87% due to the fire protection requirements RE 15

SLS

Deflection (33%)
 Left cantilever: ($l_{eff} = 276.76$): $a / a_{lim} = -1.66 / 23 = 0.07 < 1.00$
 Span 1: ($l_{eff} = 276.76$): $a / a_{lim} = 13.08 / 40 = 0.33 < 1.00$
 Span 2: ($l_{eff} = 276.76$): $a / a_{lim} = 5.56 / 40 = 0.14 < 1.00$
 Span 3: ($l_{eff} = 553.52$): $a / a_{lim} = 10.89 / 40 = 0.27 < 1.00$
 Right cantilever: ($l_{eff} = 553.52$): $a / a_{lim} = -6.60 / 23 = 0.29 < 1.00$

The maximum strength for the Serviceability Limit State (SLS) is 33%



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SGN and SGU

Results of specific calculation positions

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Interaction on the internal support (106%)
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The maximum strength for the Serviceability Limit State (SLS) is 33%

In the SGN field we will find information about the calculations performed. The number of calculations will vary depending on the complexity of our task.

In red the results of the calculation in which the load capacity is exceeded will be marked

In the summary, the load limitation we have entered will be 'reminded'. If it is exceeded, the message will also be in red (if the load capacity utilisation is less than 100% but at the same time greater than the permissible load level, the message will be displayed in red but the calculation position will not be highlighted)

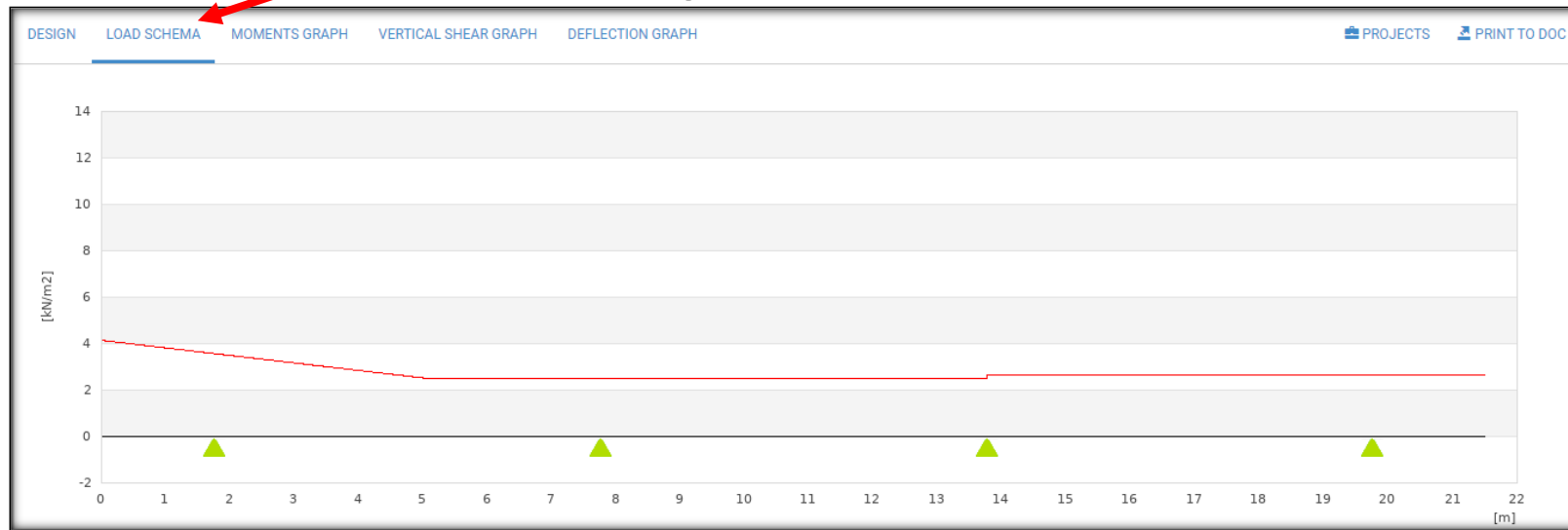
In the SGU field, you will find information about the deflection value. If the value is greater than the permissible value the exceedance will be highlighted in red. In the summary we will also be informed in red about the exceedance.

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LOADING SCHEME

Results of specific calculation positions

The second tab allows us to view the load diagram.



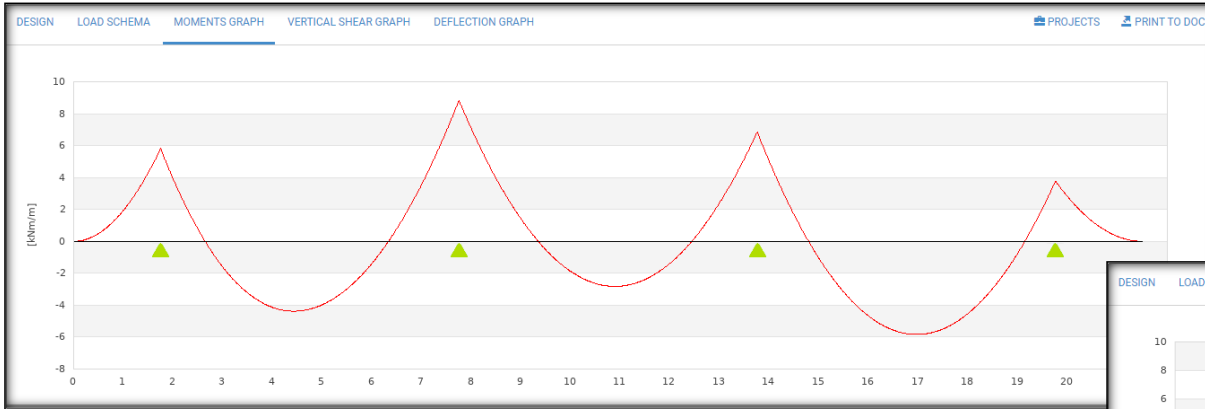
Using this tab, you can first of all determine the correctness of the previously specified loads. This is particularly important in more complex calculation situations, for many different loads or in the case of variable values (e.g. from snow) where it is easy to make mistakes. The diagram also makes it possible to assess whether a large error has been made somewhere and the loads are not extremely over- or underestimated.



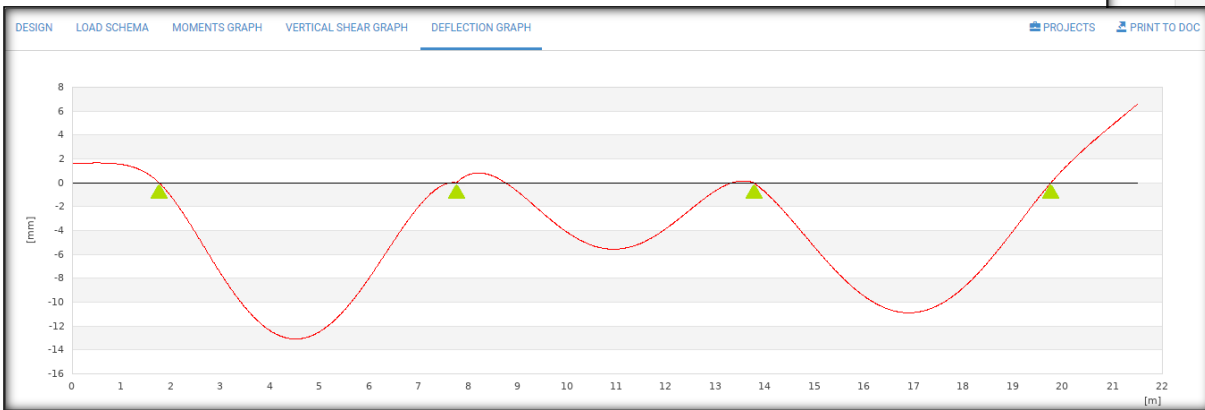
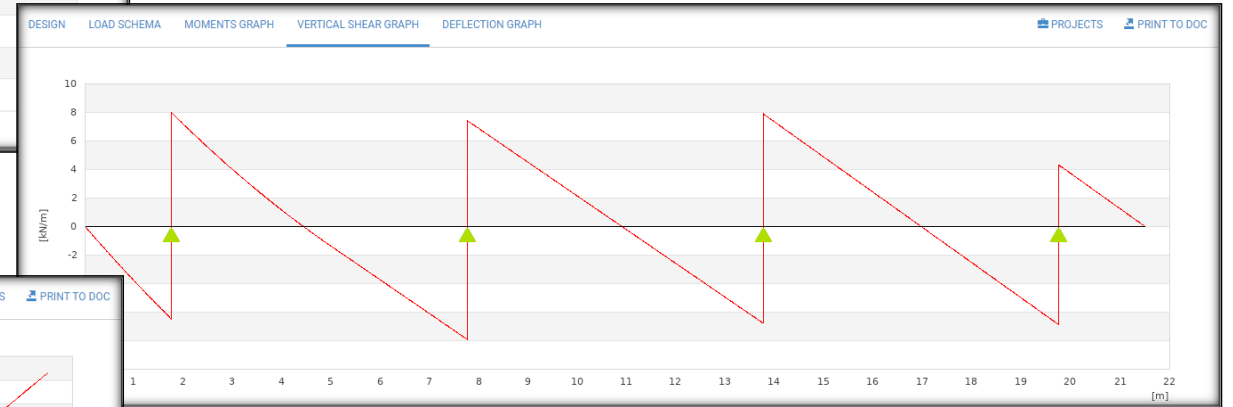
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GRAPHS

Graph of moments, shearing forces and deflections



The other tabs contain graphs of moments, shear forces and deflections. The values at the characteristic points can be found in the first tab "Dimensioning".

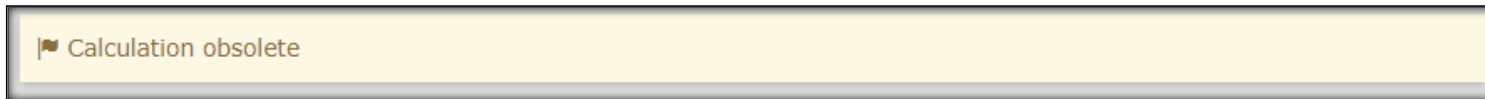


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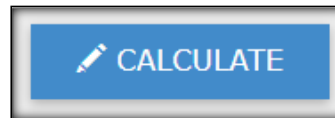
Editing calculated data

If some of the results are incorrect (highlighted in red), or the level of use is lower than we would expect, knowing the results we can easily make adjustments. With everything visible on one screen, we can easily search for the most optimal solution in a few moments.

Making changes automatically means that previous calculations, although still visible, will no longer be up to date, of which we will be informed by the following message



Another use of "CALCULATE" will bring you closer to the expected result.



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We encourage you to use our programme free of charge. Should you have any problems, our technical team will be happy to clarify any doubts.

We are constantly developing our software. We believe that the accessibility, intuitiveness, functionality and clarity of SPANer will make your work easier and enable you to make the best possible selection of the profiled sheets offered by ArcelorMittal Constuction.

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