

SWE2 v0.6

A program system for the reporting of deflections, internal forces, and stresses of *sandwich beams* with stiff or flexible steel faces, resulting from external loads or temperature differences of the faces.

SWE2 is open source and may be achieved at WWW.SWE2.DE.

Inspired by an article of K. Schwarze.

Report No.: 01215

Originator: Dirk H. Urbanek*

Editor: Dipl.-Ing. Dirk H. Urbanek

10.11.2008

Project: Article in Stahlbau 12/1984

Item: Computation Example

Compare the results

Contents

1	Input	2
1.1	Measurements	2
1.2	Cross-section	2
1.3	Loadings	3
2	Deflection	4
3	Bending moments and resulting stress	5
4	Shear force, reaction, and shear stress	6

*ZBN Civil Engineers Ltd. (WWW.ZBN.DE)

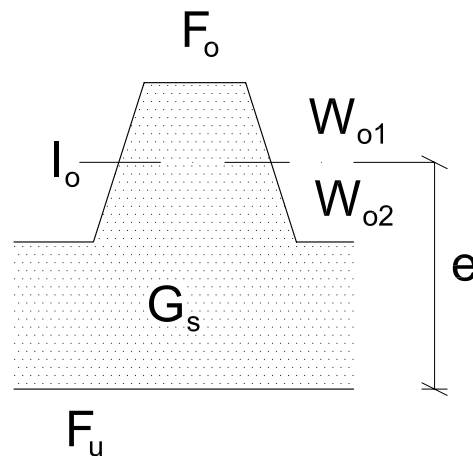
1 Input

This report consists of 6 pages. This report has been computed with a resolution of 20480 sections.

1.1 Measurements

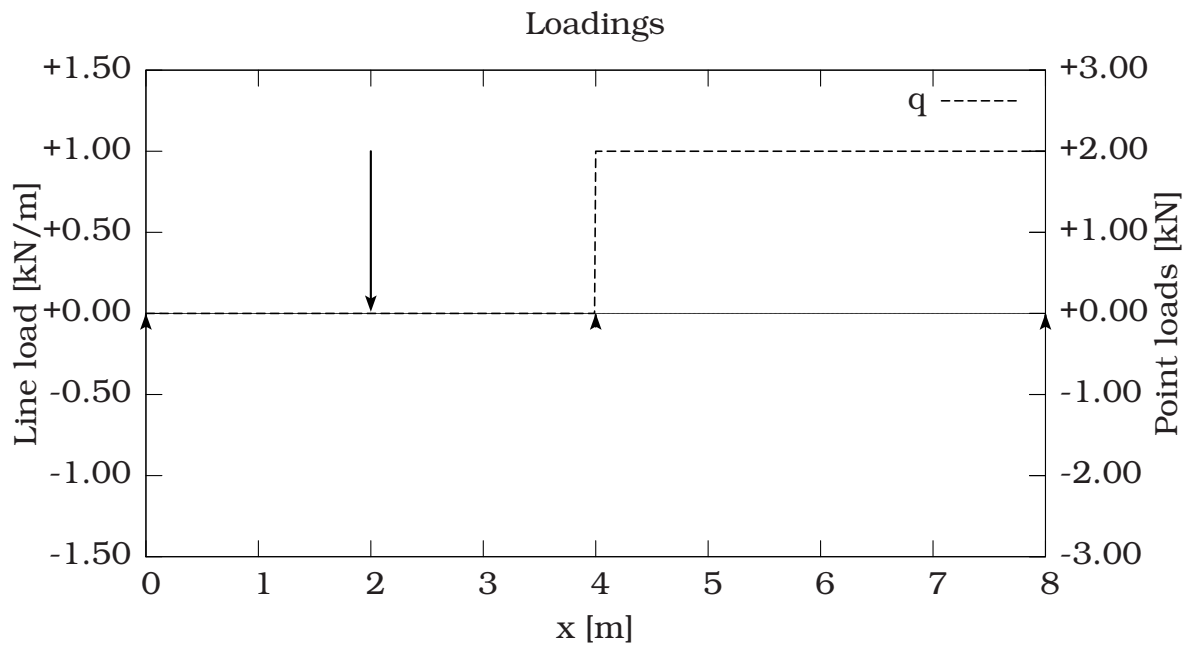
two span beam without cantilever	
Span width 1:	4 m
Span width 2:	4 m
Total length:	8 m

1.2 Cross-section



Cross-section values		
Measured depth between the centroids of the faces	e	5.33 cm
Cross-sectional area of the top face	F_o	8.45 cm ²
Moment of inertia of the top face	I_o	17.27 cm ⁴
Upper moment of resistance of the top face	W_{o1}	14.39 cm ³
Lower moment of resistance of the top face	W_{o2}	7.51 cm ³
Lower moment of resistance of the top face	F_u	5.10 cm ²
Material characteristics		
	G_s	0.39 kN/cm ²
Modulus of elasticity of the faces	E	21000 kN/cm ²
Thermal expansion rate of the faces	α	11.7e-6 m/Km

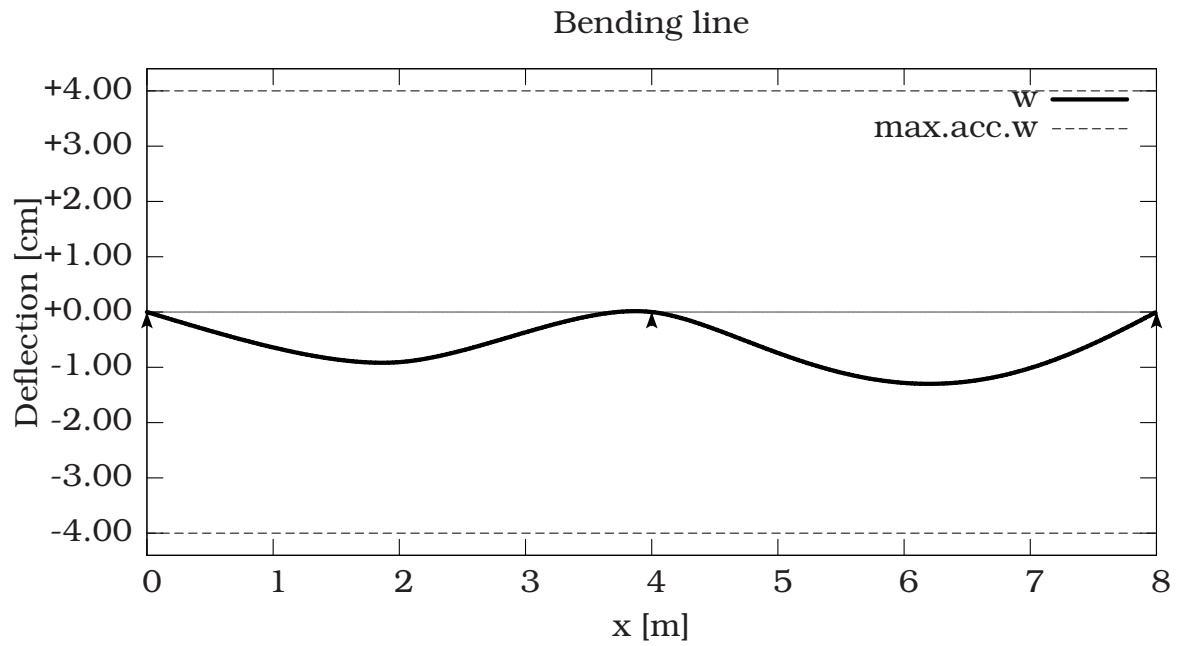
1.3 Loadings



Input				
Start	Start	Initial value	Length	Final value
Point Load	2.00 m	2.00 kN		
Rectangle load	4.00 m	1.00 kN/m	4.00 m	

Summary	
Sum of line loads:	4.00 kN
Sum of point loads:	2.00 kN
Sum of burden:	6.00 kN
Temperature	
Temperature of the top face:	20.00 °C
Temperature of the bottom face:	20.00 °C
Temperature gap:	0.00 K

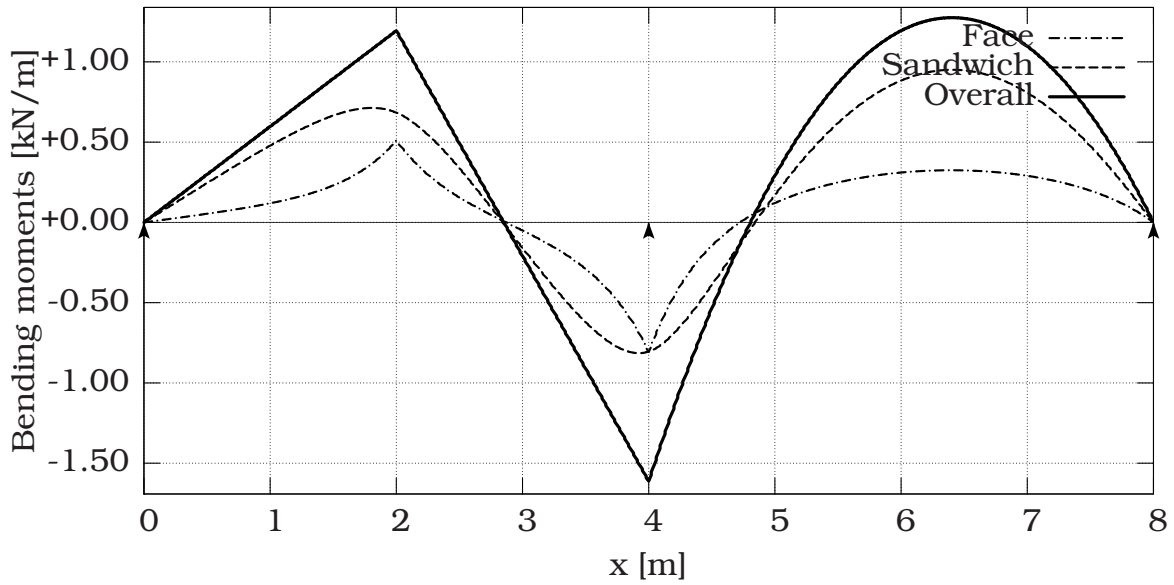
2 Deflection



Deflection		
Maximal:	0.016	cm
Minimal:	-1.299	cm

3 Bending moments and resulting stress

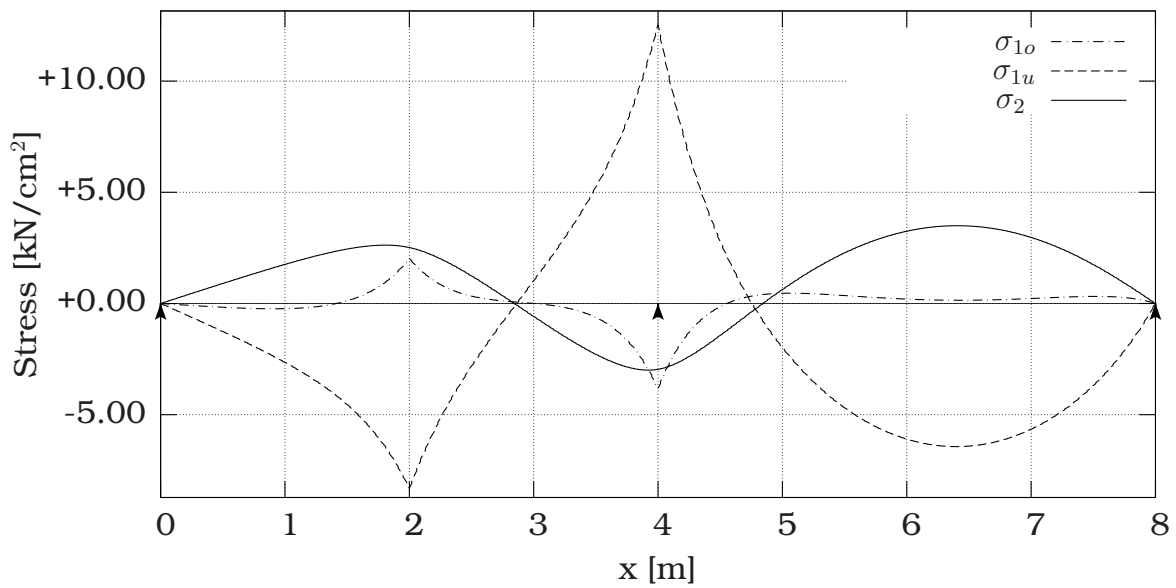
Bending moments



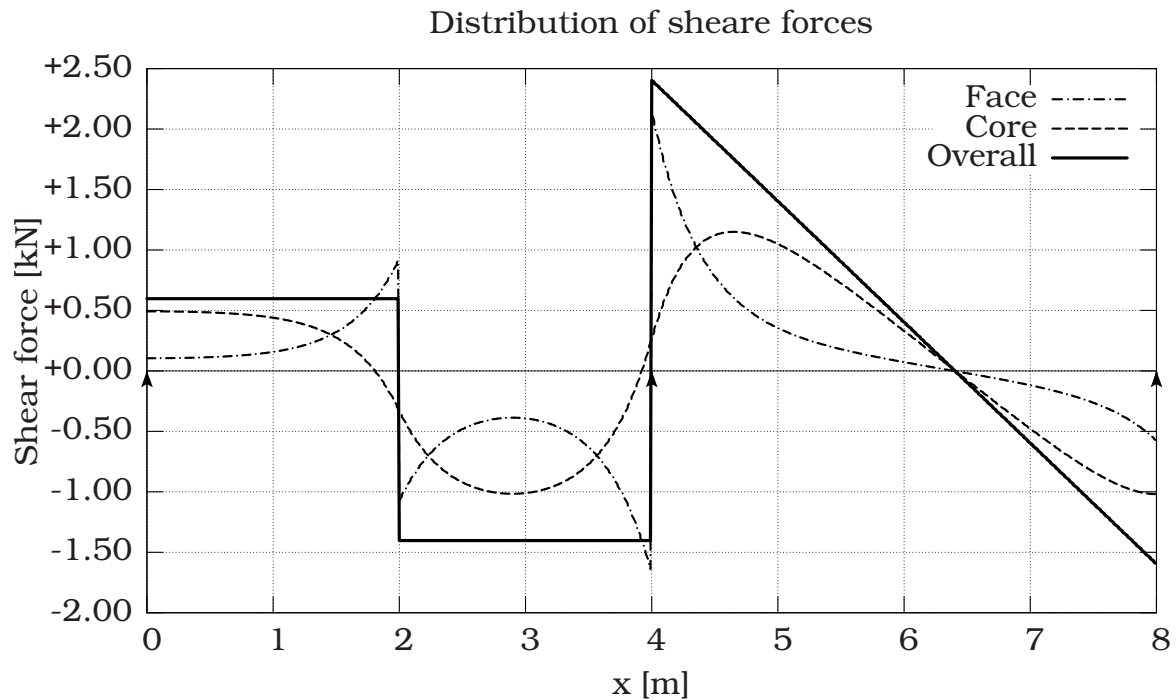
Moments	min	max		σ^a	min	max	
Face	-0.807	0.510	kNm	σ_{1o}	-3.820	2.026	kN/cm ²
Sandwich	-0.814	0.950	kNm	σ_{1u}	-8.307	12.527	kN/cm ²
Overall	-1.611	1.275	kNm	σ_2	-2.996	3.497	kN/cm ²

^aBending stresses of the faces

Distribution of stress



4 Shear force, reaction, and shear stress



Support:	1	2	3	
Position:	0.00	4.00	8.00	m
Reaction:	0.60	3.81	1.60	kN
Shear force left:	0.00	-1.40	-1.60	kN
Shear force, right:	-0.60	-2.40	0.00	kN

Length of beam: 8.00 m

Sum of reactions: 6.00 kN

Maximal shear core force Q_S : 1.15 kN

Maximal shear stress τ_S : 0.022 N/mm²

Editor: Dipl.-Ing. Dirk H. Urbanek
 ZBN Civil Engineers Ltd
 Coubertin-Str. 1
 48301 Nottuln - Germany
 www.zbn.de info@zbn.de
 Tel.: 49/2502/94576
 Reports for metal light-weight constructions
 advise, development, report
 design, expertise, certificate worldwide
