Single Span Tests **Ultimate moment in span**

test no. SSP-…	t_{cor} mm	$t_{cor,obs}$ mm	R m	L_V m	g kN/m²	f_{yb} N/mm²	$f_{yb,obs}$ N/mm²	L m	b_V m	F_u kN	P_{vor} kN	1/μ -	$F_{u,adj}$ kN	$F_{u,adj}/F_{u,m}$ -	$F_{u,k}$ kN/m	$M_{c,Rk,F}$ kNm/m
18-0-063-1	0,527	0,527	**flat**	2,20	0,059	329,3	329,3	2,00	0,912	3,71	0,00	1,000	3,710	0,9521	4,112	**1,057**
18-0-063-2	0,527	0,527		2,20	0,059	329,3	329,3	2,00	0,912	4,07	0,00	1,000	4,070	1,0445		
18-0-063-3	0,527	0,527		2,20	0,059	329,3	329,3	2,00	0,912	3,91	0,00	1,000	3,910	1,0034		
18-30-063-1	0,527	0,527	**11,5**	2,20	0,059	329,3	329,3	2,00	0,912	3,97	0,00	1,000	3,970	1,0051	4,168	**1,071**
18-30-063-2	0,527	0,527		2,20	0,059	329,3	329,3	2,00	0,912	3,93	0,00	1,000	3,930	0,9949		
18-61-063-1	0,527	0,527	**9,6**	2,20	0,059	329,3	329,3	2,00	0,912	4,11	0,00	1,000	4,110	1,0123	4,284	**1,100**
18-61-063-2	0,527	0,527		2,20	0,059	329,3	329,3	2,00	0,912	4,01	0,00	1,000	4,010	0,9877		
18-154-063-1	0,527	0,527	**4,3**	2,20	0,059	329,3	329,3	2,00	0,912	4,98	0,00	1,000	4,980	1,0122	5,192	**1,327**
18-154-063-2	0,527	0,527		2,20	0,059	329,3	329,3	2,00	0,912	4,86	0,00	1,000	4,860	0,9878		
18-0-100-1	0,993	0,993	**flat**	3,20	0,093	348,7	348,7	3,00	0,912	4,10	0,00	1,000	4,100	1,0000	4,326	**1,727**
18-64-100-1	0,993	0,993	**17,2**	3,20	0,093	348,7	348,7	3,00	0,912	4,20	0,00	1,000	4,200	1,0182	4,353	**1,736**
18-64-100-2	0,993	0,993		3,20	0,093	348,7	348,7	3,00	0,912	4,10	0,00	1,000	4,100	0,9939		
18-64-100-3	0,993	0,993		3,20	0,093	348,7	348,7	3,00	0,912	4,10	0,00	1,000	4,100	0,9939		
18-64-100-4	0,993	0,993		3,20	0,093	348,7	348,7	3,00	0,912	4,10	0,00	1,000	4,100	0,9939		
18-129-100-1	0,993	0,993	**10,6**	3,20	0,093	348,7	348,7	3,00	0,912	4,00	0,00	1,000	4,000	1,0084	4,186	**1,674**
18-129-100-2	0,993	0,993		3,20	0,093	348,7	348,7	3,00	0,912	4,00	0,00	1,000	4,000	1,0084		
18-129-100-3	0,993	0,993		3,20	0,093	348,7	348,7	3,00	0,912	3,90	0,00	1,000	3,900	0,9832		
18-334-100-1	0,993	0,993	**3,8**	3,20	0,093	348,7	348,7	3,00	0,912	3,80	0,00	1,000	3,800	0,9661	4,151	**1,661**
18-334-100-2	0,993	0,993		3,20	0,093	348,7	348,7	3,00	0,912	4,00	0,00	1,000	4,000	1,0169		
18-334-100-3	0,993	0,993		3,20	0,093	348,7	348,7	3,00	0,912	4,00	0,00	1,000	4,000	1,0169		
39-0-063-1	0,580	0,580	**flat**	3,20	0,060	408,3	408,3	3,00	1,000	2,09	0,00	1,000	2,090	1,0503	1,915	**0,785**
39-0-063-2	0,580	0,580		3,20	0,060	408,3	408,3	3,00	1,000	2,03	0,00	1,000	2,030	1,0201		
39-0-063-2	0,580	0,580		3,20	0,060	408,3	408,3	3,00	1,000	1,85	0,00	1,000	1,850	0,9296		
39-64-063-1	0,580	0,580	**32,9**	3,20	0,060	408,3	408,3	3,00	1,000	1,92	0,00	1,000	1,920	0,9897	1,867	**0,767**
39-64-063-2	0,580	0,580		3,20	0,060	408,3	408,3	3,00	1,000	1,96	0,00	1,000	1,960	1,0103		
39-129-063-1	0,580	0,580	**9,7**	3,20	0,060	408,3	408,3	3,00	1,000	1,84	0,00	1,000	1,840	0,9973	1,776	**0,733**
39-129-063-2	0,580	0,580		3,20	0,060	408,3	408,3	3,00	1,000	1,85	0,00	1,000	1,850	1,0027		
39-217-063-1	0,580	0,580	**5,6**	3,20	0,060	408,3	408,3	3,00	1,000	1,61	0,00	1,000	1,610	1,0021	1,546	**0,647**
39-217-063-2	0,580	0,580		3,20	0,060	408,3	408,3	3,00	1,000	1,56	0,00	1,000	1,560	0,9710		
39-217-063-3	0,580	0,580		3,20	0,060	408,3	408,3	3,00	1,000	1,65	0,00	1,000	1,650	1,0270		
39-0-100-1	0,957	0,957	**flat**	4,20	0,095	381,7	381,7	4,00	1,000	2,80	0,00	1,000	2,800	0,9982	2,699	**1,539**
39-0-100-2	0,957	0,957		4,20	0,095	381,7	381,7	4,00	1,000	2,81	0,00	1,000	2,810	1,0018		
39-111-100-1	0,957	0,957	**25,8**	4,20	0,095	381,7	381,7	4,00	1,000	2,78	0,00	1,000	2,780	1,0109	2,646	**1,513**
39-111-100-2	0,957	0,957		4,20	0,095	381,7	381,7	4,00	1,000	2,72	0,00	1,000	2,720	0,9891		
39-223-100-1	0,957	0,957	**10,6**	4,20	0,095	381,7	381,7	4,00	1,000	2,81	0,00	1,000	2,810	0,9982	2,709	**1,544**
39-223-100-2	0,957	0,957		4,20	0,095	381,7	381,7	4,00	1,000	2,82	0,00	1,000	2,820	1,0018		
39-380-100-1	0,957	0,957	**6,4**	4,20	0,095	381,7	381,7	4,00	1,000	2,82	0,00	1,000	2,820	0,9947	2,728	**1,554**
39-380-100-2	0,957	0,957		4,20	0,095	381,7	381,7	4,00	1,000	2,85	0,00	1,000	2,850	1,0053		

					38,000
number		38		s	0,0218
	EC	k =	1,73	(1-k·s)	0,9624

Single Span Tests with horizontal supports

Characteristic failure load

test no.	t_{cor}	$t_{cor,obs}$	R	L_V	g	f_{yb}	$f_{yb,obs}$	L	b_V	F_u	P_{vor}	1/μ	$F_{u,adj}$	$F_{u,adj}/F_{u,m}$	$F_{u,k}$
SSP-H-39-…	mm	mm	m	m	kN/m²	N/mm²	N/mm²	m	m	kN	kN	-	kN	-	kN/m
217-063-1	0,580	0,580	**5,56**	3,20	0,060	408,3	408,3	3,00	0,667	9,12	0,00	1,000	9,120	1,0094	**11,027**
217-063-2	0,580	0,580		3,20	0,060	408,3	408,3	3,00	0,667	8,95	0,00	1,000	8,950	0,9906	
380-063-1	0,580	0,580	**6,02**	4,20	0,060	408,3	408,3	4,00	0,667	9,49	0,00	1,000	9,490	0,8911	**12,767**
380-063-2	0,580	0,580		4,20	0,060	408,3	408,3	4,00	0,667	11,43	0,00	1,000	11,430	1,0732	
380-063-3	0,580	0,580		4,20	0,060	408,3	408,3	4,00	0,667	11,03	0,00	1,000	11,030	1,0357	
576-063-1	0,580	0,580	**7,04**	5,20	0,060	408,3	408,3	5,00	0,667	5,67	0,00	1,000	5,670	0,9626	**6,615**
576-063-2	0,580	0,580		5,20	0,060	408,3	408,3	5,00	0,667	5,17	0,00	1,000	5,170	0,8778	
576-063-3	0,580	0,580		5,20	0,060	408,3	408,3	5,00	0,667	6,83	0,00	1,000	6,830	1,1596	

					8,000
	number	8		s	0,0930
	EC	k =	2,00	(1-k·s)	0,8141

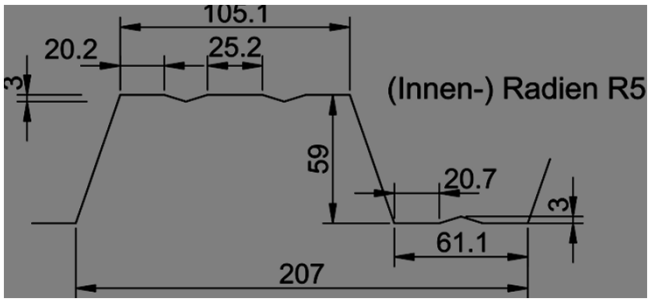
characteristic values according EN 1993-1-3

Arcelor 39/333 positive position = wide flange upside

Spread sheet is valid for profiles with 2 stiffeners in the upper flange and no stiffeners in the webs and in the lower flange!

data

material	f_y	408,3	δ	1,5							
	E	210000						perforation yes/no		support width	
			h	38,5				"=1/0“		$b_{A,1}$	10
upper flange	b_o	258,00				φ_1	55,3087	0		$b_{A,2}$	40
	b_p	58,00								$b_{B,1}$	10
	b_m	58,00								$b_{B,2}$	60
	h_r	3,50								$b_{B,3}$	160
	c_r	36,00								perforation	
										d	0
lower flange	b_u	22								a	12,22
	b_{pu}	0								s_{perf}	0
	h_{ru}	0,0								self-weight	
	c_{ru}	0			inner radii			for support		b_{coil}	1190 mm
pitch					r_o	5	mm	5		b_{cover}	1000 mm
	b_{R0}	333,3			r_u	5	mm	5		ρ	80 kN/m³



sheet thickn	t_N in mm	0,620	0,620	0,620	0,620	0,620	0,620	0,620	diaphragm values		
	t_{cor} in mm	0,580	0,580	0,580	0,580	0,580	0,580	0,580	0	Strehl	

Bending moment

	positive position M(+)			negative position M(-)			lt.- check M(+)		lt.- check M(-)	
t_{nom}	M_k (+)	e_c(+)	Σ H_i	M_k (-)	e_c(-)	Σ H_i	min e	max e	min e	max e
mm	kNm/m	mm	N	kNm/m	mm	N	mm	mm	mm	mm
0,62	1,426	13,22	0	1,093	6,75	0	4,00	31,50	4,00	31,50

Moment of inertia (ELS)

	positive		negative		lt.- check J_{ef}(+)		lt.- check J_{ef}(-)	
t_{nom}	J_{ef} (+)	e_c(+)	J_{ef} (-)	e_c(-)	min e	max e	min e	max e
mm	cm^4/m	mm	cm^4/m	mm	mm	mm	mm	mm
0,62	8,52	10,29	9,77	7,66	7,00	32,50	7,00	32,50

Axial compression

	gross cross section				effective cross section				self weight
t_{nom}	J_g	A_g	i_g	$z_{g,o}$	$J_{eff,comp}$	A_{ef}	i_{ef}	$z_{ef,o}$	g_{voll}
mm	cm^4/m	cm^2/m	cm	cm	cm^4/m	cm^2/m	cm	cm	kN/m²
0,62	9,77	6,5829	1,218	0,77	5,21	1,8895	1,660	1,48	0,0590

Support reaction

	negative position										
	end support				intermediate support						V
t_{nom}	$l_{A,1}$	$R_{k,A1}$	$l_{A,2}$	$R_{k,A2}$	$l_{B,1}$	$R_{k,B,1}$	$l_{B,2}$	$R_{k,B,2}$	$l_{B,3}$	$R_{k,B,3}$	$V_{R.k}$
mm	mm	kN/m	mm	kN/m	mm	kN/m	mm	kN/m	mm	kN/m	kN/m
0,62	10	2,99	40	4,61	10	5,98	60	10,66	160	15,67	21,32

Attention: The definition positive/negative in this spread sheet is opposite to the definition used in the main part!

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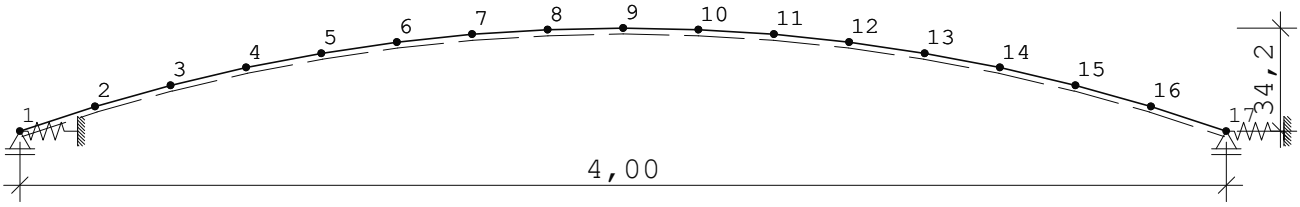
PLANE FRAME ANALYSIS ESK1 06/2003 WinVista sheet 1

PROJECT: 003 GRISPE - Curved profiles SUB: AR-4g-te
Name: Arch Span 4 m C 62 (test)

System scale 1 : 25



MATERIAL : Sonstiges E-modulus E = 21000 kN/cm2 GammaM = 1.00
unit weight : 7.85 kg/dm3

SECTION PROPERTIES

Cross-sect. No.	Mat	Profile Name	I (cm4)	A (cm2)	Aq (cm2)	h (cm)	S top (cm3)	S bot (cm3)
1	1	Arcelor 3	9.77	6.58	0.000	0.00	0.000	0.000
2	1	Arcelor 3	5.21	1.89	0.000	0.00	0.000	0.000

Cross section 1 : Arcelor 39-0,63-Ag
Cross section 2 : Arcelor 39-0,63-Aef

SYSTEM Member	Projections Lx (m)	Lz (m)	Cross-section Q1	Q2	N o d e s End 1	End 2
1	0.250	0.082	1	1	1.0	2.0
2	0.250	0.070	1	1	2.0	3.0
3	0.250	0.059	1	1	3.0	4.0
4	0.250	0.047	1	1	4.0	5.0
5	0.250	0.037	1	1	5.0	6.0
6	0.250	0.026	1	1	6.0	7.0
7	0.250	0.015	1	1	7.0	8.0
8	0.250	0.006	1	1	8.0	9.0
9	0.250	-0.006	1	1	9.0	10.0
10	0.250	-0.015	1	1	10.0	11.0
11	0.250	-0.026	1	1	11.0	12.0
12	0.250	-0.037	1	1	12.0	13.0
13	0.250	-0.047	1	1	13.0	14.0
14	0.250	-0.059	1	1	14.0	15.0
15	0.250	-0.070	1	1	15.0	16.0
16	0.250	-0.082	1	1	16.0	17.0

SUPPORTS : -1 = rigid , 0 = free , > 0 = elastic (kN/cm , kNcm)

Node	horizontal	vertical	rotating
1	62.00	-1	0
17	62.00	-1	0

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PLANE FRAME ANALYSIS ESK1 06/2003 WinVista sheet 2

PROJECT: 003 GRISPE - Curved profiles SUB: AR-4g-te
Name: Arch Span 4 m C 62 (test)

Nodes	C o o r d i n a t e s		Differences	
No.	x (m)	z (m)	d x (m)	d z
1	-2.000	0.000		
2	-1.750	0.082		
3	-1.500	0.152		
4	-1.250	0.211		
5	-1.000	0.258		
6	-0.750	0.295		
7	-0.500	0.321		
8	-0.250	0.336		
9	0.000	0.342		
10	0.250	0.336		
11	0.500	0.321		
12	0.750	0.295		
13	1.000	0.258		
14	1.250	0.211		
15	1.500	0.152		
16	1.750	0.082		
17	2.000	0.000		

Weight of construction G = 21 kg

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PLANE FRAME ANALYSIS ESK1 06/2003 WinVista sheet 3

PROJECT: 003 GRISPE - Curved profiles SUB: AR-4g-te
Name: Arch Span 4 m C 62 (test)

L O A D I N G No. 4 Load case : char failure load

Nodal loads

Node	Force H	Force V	Moment M	(kN) (kNm)
3	0.000	3.193	0.000	
7	0.000	3.193	0.000	
11	0.000	3.193	0.000	
15	0.000	3.193	0.000	

Sum of all external loads (kN)

Total	Fx	Fz
	0.000	12.772

Maximum displacement in member 9 at x = 0.00 * L Max_f = 1.44 cm

SUPPORT REACTIONS Th. 1.Ord. Load case 4 : char failure load

Node	Force H	Force V	Moment M (kN) (kNm)
1	-18.636	6.386	
17	18.636	6.386	
Sum :	0.000	12.772	

INTERNAL FORCES Th. 1.Ord. Load case 4 : char failure load

member No.	Q node No.	No.	Q (kN)	N (kN)	M (kNm)
1	1	1	0.26	-19.70	0.00
	.50		0.26	-19.70	0.03
	1	2	0.26	-19.70	0.07
2	1	2	1.12	-19.67	0.07
	.50		1.12	-19.67	0.21
	1	3	1.12	-19.67	0.36
3	1	3	-1.17	-18.87	0.36
	.50		-1.17	-18.87	0.21
	1	4	-1.17	-18.87	0.06
4	1	4	-0.31	-18.90	0.06
	.50		-0.31	-18.90	0.02
	1	5	-0.31	-18.90	-0.02
5	1	5	0.43	-18.90	-0.02
	.50		0.43	-18.90	0.04
	1	6	0.43	-18.90	0.09
6	1	6	1.25	-18.87	0.09
	.50		1.25	-18.87	0.25

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PLANE FRAME ANALYSIS ESK1 06/2003 WinVista sheet 4

PROJECT: 003 GRISPE - Curved profiles SUB: AR-4g-te
Name: Arch Span 4 m C 62 (test)

INTERNAL FORCES Th. 1.Ord. Load case 4 : char failure load

member No.	Q No.	node No.	Q (kN)	N (kN)	M (kNm)
	1	7	1.25	-18.87	0.40
7	1	7	-1.12	-18.60	0.40
	.50		-1.12	-18.60	0.26
	1	8	-1.12	-18.60	0.12
8	1	8	-0.45	-18.63	0.12
	.50		-0.45	-18.63	0.07
	1	9	-0.45	-18.63	0.01
9	1	9	0.45	-18.63	0.01
	.50		0.45	-18.63	0.07
	1	10	0.45	-18.63	0.12
10	1	10	1.12	-18.60	0.12
	.50		1.12	-18.60	0.26
	1	11	1.12	-18.60	0.40
11	1	11	-1.25	-18.87	0.40
	.50		-1.25	-18.87	0.25
	1	12	-1.25	-18.87	0.09
12	1	12	-0.43	-18.90	0.09
	.50		-0.43	-18.90	0.04
	1	13	-0.43	-18.90	-0.02
13	1	13	0.31	-18.90	-0.02
	.50		0.31	-18.90	0.02
	1	14	0.31	-18.90	0.06
14	1	14	1.17	-18.87	0.06
	.50		1.17	-18.87	0.21
	1	15	1.17	-18.87	0.36
15	1	15	-1.12	-19.67	0.36
	.50		-1.12	-19.67	0.21
	1	16	-1.12	-19.67	0.07
16	1	16	-0.26	-19.70	0.07
	.50		-0.26	-19.70	0.03
	1	17	-0.26	-19.70	0.00

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PLANE FRAME ANALYSIS ESK1 06/2003 WinVista sheet 5

PROJECT: 003 GRISPE - Curved profiles SUB: AR-4g-te
Name: Arch Span 4 m C 62 (test)

DISPLACEMENTS Th. 1.Ord. Load case 4 : char failure load

Node No.	Displacement u (cm)	Displacement v (cm)	Rotation r
1	-0.30057	0.00000	0.01356
2	-0.19415	0.33648	0.01312
3	-0.11321	0.63928	0.01041
4	-0.06482	0.85959	0.00778
5	-0.03264	1.04961	0.00753
6	-0.00860	1.23562	0.00709
7	0.00331	1.38333	0.00406
8	0.00319	1.43762	0.00084
9	0.00000	1.44530	0.00000
10	-0.00319	1.43762	-0.00084
11	-0.00331	1.38333	-0.00406
12	0.00860	1.23562	-0.00709
13	0.03264	1.04961	-0.00753
14	0.06482	0.85959	-0.00778
15	0.11321	0.63928	-0.01041
16	0.19415	0.33648	-0.01312
17	0.30057	0.00000	-0.01356

DISPLACEMENT OF SPANS (cm) Th. 1.Ord. Load case 4 : char failu

Member No.	End 1	x/L =							End 2
	0	1/8	2/8	3/8	4/8	5/8	6/8	7/8	1
1	-0.09	-0.05	0.00	0.04	0.08	0.13	0.17	0.22	0.26
2	0.27	0.31	0.36	0.40	0.44	0.48	0.51	0.55	0.59
3	0.60	0.63	0.66	0.69	0.72	0.74	0.77	0.80	0.82
4	0.83	0.86	0.88	0.91	0.93	0.95	0.98	1.00	1.03
5	1.03	1.06	1.08	1.10	1.13	1.15	1.18	1.20	1.22
6	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.36	1.38
7	1.38	1.39	1.40	1.41	1.42	1.42	1.43	1.43	1.44
8	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
9	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
10	1.44	1.43	1.43	1.42	1.42	1.41	1.40	1.39	1.38
11	1.38	1.36	1.35	1.33	1.31	1.29	1.27	1.25	1.23
12	1.22	1.20	1.18	1.15	1.13	1.10	1.08	1.06	1.03
13	1.03	1.00	0.98	0.95	0.93	0.91	0.88	0.86	0.83
14	0.82	0.80	0.77	0.74	0.72	0.69	0.66	0.63	0.60
15	0.59	0.55	0.51	0.48	0.44	0.40	0.36	0.31	0.27
16	0.26	0.22	0.17	0.13	0.08	0.04	0.00	-0.05	-0.09

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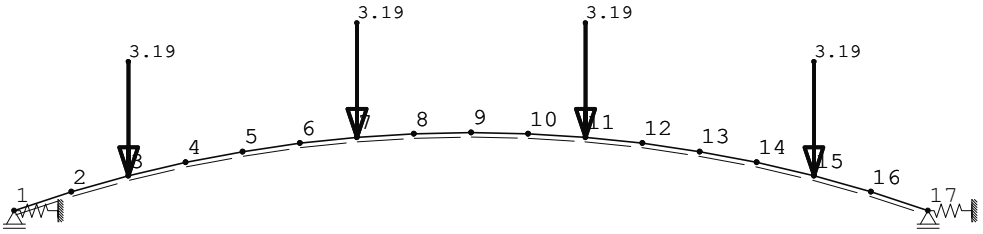
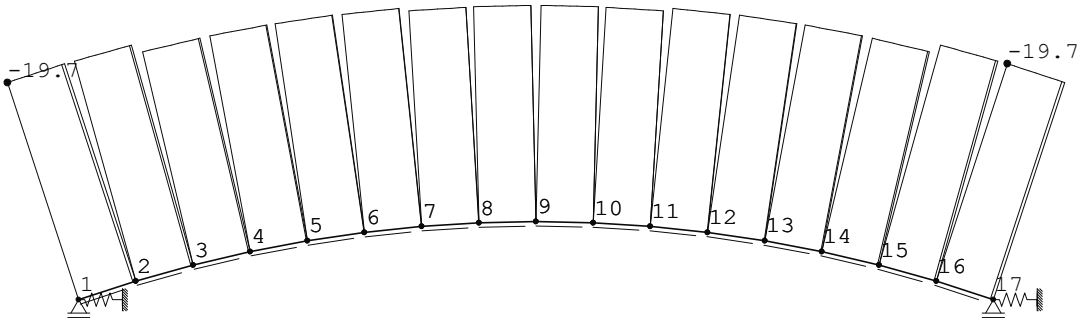
PLANE FRAME ANALYSIS ESK1 06/2003 WinVista sheet 6

PROJECT: 003 GRISPE - Curved profiles SUB: AR-4g-te
Name: Arch Span 4 m C 62 (test)

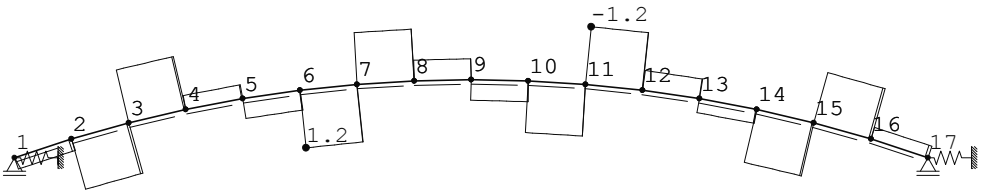
Loads load case no. 4 M 1 : 33



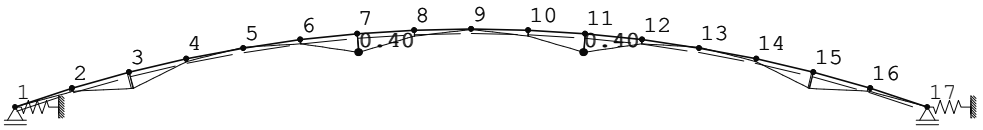
Normal force (kN) load case no. 4 Th.2.Ord. M 1 : 33



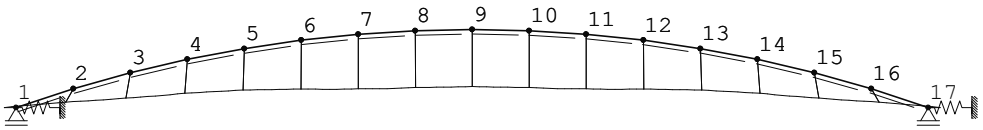
Shear force (kN) load case no. 4 Th.2.Ord. M 1 : 33



Moments (kNm) load case no. 4 Th.2.Ord. M 1 : 33



Displacement (cm) load case no. 4 Th.2.Ord. M 1 : 33



Failure load compared with M-N-interaction formula according to DIN 18807

Test setup/ span	Cross section	spring stiffness at support (kN/m/cm)	M- / N-values (kNm/m, kN/m) at load point near to summit max M	corresp N	at support max N	relative m M/M_d	DIN 18807 with limit $\alpha < 1$ relative n N/N_{dD}*[1+0,5 α …]	m + n		DIN 18807 without limit α relative n N/N_{dD}*[1+0,5 α …]	m + n		system parameters	
1 / 3,00 m	gross	fixed	0,17	20,62	21,19	0,156	0,583	0,74	slenderness α = 1,297	0,620	0,78	slenderness α = 1,297	arch height (mm)	206,3
		68,0	0,49	18,98	19,60	0,448	0,544	0,99	σ_{cd} / f_{yk} = 0,583	0,580	1,03	σ_{cd} / f_{yk} = 0,583	arch length (mm)	3.038
		20,0	1,08	15,94	16,65	0,988	0,469	1,46	ult N_{dD} = (kN/m) 44,95	0,503	1,49	ult N_{dD} = (kN/m) 44,95	f/l =	0,069
		10,0	1,65	13,01	13,80	1,510	0,392	1,90	decisive N_{dD} = 44,95	0,423	1,93	decisive N_{dD} = 44,95	coefficient β	1,01
	effective	fixed	0,19	20,51	21,08	0,174	0,580	0,75		0,617	0,79		buckling length s_k	1.534
		88,0	0,33	19,80	20,40	0,302	0,564	0,87		0,600	0,90		max N_{dD} = (kN/m)	68,82
		20,0	0,73	17,74	18,39	0,668	0,514	1,18		0,550	1,22			
		10,0	1,14	15,64	16,35	1,043	0,461	1,50		0,495	1,54			
2 / 4,00 m	gross	fixed	0,25	19,35	20,16	0,229	0,758	0,99	slenderness α = 1,758	0,845	1,07	slenderness α = 1,758	arch height (mm)	341,7
		62,0	0,40	18,87	19,70	0,366	0,745	1,11	σ_{cd} / f_{yk} = 0,390	0,833	1,20	σ_{cd} / f_{yk} = 0,390	arch length (mm)	4.077
		20,0	0,71	17,92	18,80	0,650	0,717	1,37	ult N_{dD} = (kN/m) 30,06	0,808	1,46	ult N_{dD} = (kN/m) 30,06	f/l =	0,085
		10,0	1,11	16,69	17,62	1,016	0,679	1,69	decisive N_{dD} = 30,06	0,772	1,79	decisive N_{dD} = 30,06	coefficient β	1,02
	effective	fixed	0,26	19,31	20,13	0,238	0,757	1,00		0,844	1,08		buckling length s_k	2.079
		79,0	0,33	19,11	19,93	0,302	0,752	1,05		0,839	1,14		max N_{dD} = (kN/m)	37,47
		20,0	0,51	18,53	19,37	0,467	0,735	1,20		0,824	1,29			
		10,0	0,75	17,80	18,68	0,686	0,713	1,40		0,804	1,49			
3 / 5,00 m	gross	fixed	0,16	9,36	9,81	0,146	0,616	0,76	slenderness α = 2,204	0,766	0,91	slenderness α = 2,204	arch height (mm)	459,2
		29,0	0,26	9,14	9,60	0,238	0,604	0,84	σ_{cd} / f_{yk} = 0,247	0,754	0,99	σ_{cd} / f_{yk} = 0,247	arch length (mm)	5.112
		20,0	0,30	9,04	9,50	0,274	0,599	0,87	ult N_{dD} = (kN/m) 19,06	0,749	1,02	ult N_{dD} = (kN/m) 19,06	f/l =	0,092
		10,0	0,43	8,74	9,22	0,393	0,583	0,98	decisive N_{dD} = 19,06	0,732	1,13	decisive N_{dD} = 19,06	coefficient β	1,02
	effective	fixed	0,16	9,35	9,80	0,146	0,615	0,76		0,766	0,91		buckling length s_k	2.607
		33,0	0,21	9,09	9,70	0,192	0,602	0,79		0,752	0,94		max N_{dD} = (kN/m)	23,83
		20,0	0,24	9,18	9,63	0,220	0,606	0,83		0,757	0,98			
		10,0	0,31	9,01	9,48	0,284	0,597	0,88		0,747	1,03			

green coloured lines: spring stiffness at support adapted to the midspan-deflection in test.
red values interaction formula is unsafe (calculated superposition in failure state < 1) blue values interaction formula is safe (calculated superposition in failure state > 1)

Failure load compared with M-N-interaction formula according to EN 1993-1-3, buckling curve b and c

Test setup/ span	Cross section	spring stiffness at support (kN/m/cm)	M- / N-values (kNm/m, kN/m) at load point near to summit max M	corresp N	at support max N	relative m M/M_d	EN 1993 buckling curve b α = 0,34 relative n N/NdD	$m^{0,8} + n^{0,8}$		EN 1993 buckling curve c α = 0,49 relative n N/NdD	$m^{0,8} + n^{0,8}$		system parameters	
1 / 3,00 m	gross	fixed	0,17	20,62	21,19	0,156	0,624	**0,91**	slenderness λ = 1,297	0,685	**0,96**	slenderness λ = 1,297	arch height (mm)	206,3
		68,0	0,49	18,98	19,60	0,448	0,574	**1,17**	Φ = 1,527	0,631	**1,22**	Φ = 1,610	arch length (mm)	3.038
		20,0	1,08	15,94	16,65	0,988	0,482	**1,55**	X = 0,428	0,530	**1,59**	X = 0,390	f/l =	0,069
		10,0	1,65	13,01	13,80	1,510	0,394	**1,86**	ult N_{dD} = (kN/m) 33,05	0,432	**1,90**	ult N_{dD} = (kN/m) 30,10	coefficient β	1,01
	effective	fixed	0,19	20,51	21,08	0,174	0,621	**0,93**	decisive N_{dD} = 33,05	0,681	**0,98**	decisive N_{dD} = 30,10	buckling length s_k	1.534
		88,0	0,33	19,80	20,40	0,302	0,599	**1,05**		0,658	**1,10**		max N_{dD} = (kN/m)	68,82
		20,0	0,73	17,74	18,39	0,668	0,537	**1,33**		0,589	**1,38**			
		10,0	1,14	15,64	16,35	1,043	0,473	**1,58**		0,520	**1,63**			
2 / 4,00 m	gross	fixed	0,25	19,35	20,16	0,229	0,955	**1,27**	slenderness λ = 1,758	1,028	**1,33**	slenderness λ = 1,758	arch height (mm)	341,7
		62,0	0,40	18,87	19,70	0,366	0,931	**1,39**	Φ = 2,309	1,002	**1,45**	Φ = 2,426	arch length (mm)	4.077
		20,0	0,71	17,92	18,80	0,650	0,884	**1,61**	X = 0,263	0,952	**1,67**	X = 0,244	f/l =	0,085
		10,0	1,11	16,69	17,62	1,016	0,824	**1,87**	ult N_{dD} = (kN/m) 20,26	0,887	**1,92**	ult N_{dD} = (kN/m) 18,82	coefficient β	1,02
	effective	fixed	0,26	19,31	20,13	0,238	0,953	**1,28**	decisive N_{dD} = 20,26	1,026	**1,34**	decisive N_{dD} = 18,82	buckling length s_k	2.079
		79,0	0,33	19,11	19,93	0,302	0,943	**1,34**		1,015	**1,40**		max N_{dD} = (kN/m)	37,47
		20,0	0,51	18,53	19,37	0,467	0,914	**1,47**		0,984	**1,53**			
		10,0	0,75	17,80	18,68	0,686	0,878	**1,64**		0,946	**1,70**			
3 / 5,00 m	gross	fixed	0,16	9,36	9,81	0,146	0,689	**0,96**	slenderness λ = 2,204	0,732	**0,99**	slenderness λ = 2,204	arch height (mm)	459,2
		29,0	0,26	9,14	9,60	0,238	0,673	**1,05**	Φ = 3,269	0,715	**1,08**	Φ = 3,419	arch length (mm)	5.112
		20,0	0,30	9,04	9,50	0,274	0,666	**1,08**	X = 0,176	0,707	**1,11**	X = 0,166	f/l =	0,092
		10,0	0,43	8,74	9,22	0,393	0,644	**1,18**	ult N_{dD} = (kN/m) 13,58	0,683	**1,21**	ult N_{dD} = (kN/m) 12,79	coefficient β	1,02
	effective	fixed	0,16	9,35	9,80	0,146	0,689	**0,96**	decisive N_{dD} = 13,58	0,731	**0,99**	decisive N_{dD} = 12,79	buckling length s_k	2.607
		33,0	0,21	9,09	9,70	0,192	0,670	**0,99**		0,711	**1,03**		max N_{dD} = (kN/m)	23,83
		20,0	0,24	9,18	9,63	0,220	0,676	**1,03**		0,718	**1,06**			
		10,0	0,31	9,01	9,48	0,284	0,664	**1,09**		0,705	**1,12**			

green coloured lines: spring stiffness at support adapted to the midspan-deflection in test.
red values interaction formula is unsafe (calculated superposition in failure state < 1) blue values interaction formula is safe (calculated superposition in failure state > 1)