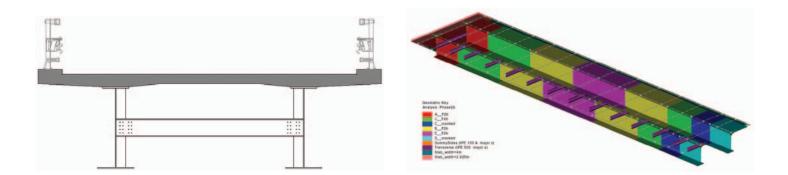


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Steel and Composite Deck Designer



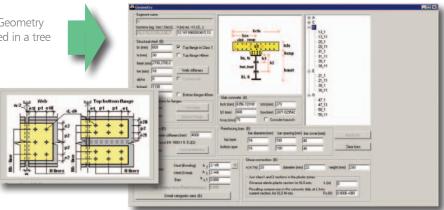
Steel and Composite Deck Designer

The Steel and Composite Deck Designer is a software option that carries out comprehensive calculations for multiple sections on steel or steel/composite bridge decks to the Eurocodes, allowing otherwise time-consuming and error-prone design calculations to be carried out efficiently. Force and moment results for specific bridge deck elements are provided by LUSAS, and loadcase combinations defined within LUSAS are associated with design limit states and phases defined in the Deck Designer.

Section definition

Deck section information is defined in the Geometry dialog of the Deck Designer and is organized in a tree structure.

Additional dialogs assist with the calculation of effective widths and shear lag; the setting of codified parameters such as fatigue damage equivalent factors for shear studs, structural steel and reinforcing bars; the specification of web and flange stiffeners, and for defining bolted connections.



Material definition

Input of material properties is straightforward and can be adjusted to suit project requirements.

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Force and moment data

Construction stages and in-service conditions are assimilated, and design combinations organised in groups. Load effects for the various sections to be checked are displayed in a spreadsheet style.

	Selfweights		and the second				1 Imposed de				
Section	N [N] 4 307E+104	VINI	M Nmi 7 333E+004	T (Nm)	-	Section	N [N]	V NI	M (han) CODIE +900	T [Nn]	- -
00	11/16-104	-10038+006				AU -			C000E+000		
L4.1						A.U.II					
						A.4.1	0.000E+000		C008-400		
A.C.II	and the second second					A.C.11					
C_S_1		-0.0002 +005	and the second s		-	13.2			C 000E +900	0.0000 +000	•
	A. Permanent					PHASE 34	Thermal act	ions	-		
Section A_1_1	N (N) 8.578E+003	V (N) -4.701% +005	M Nmi 7:590E+003	T (Nes) -2.902E -000	1	Section	11 (PU)	V (H)	Mighiel	T (Net)	forst bill
A_1_11	£.354E+003	3547E+005	314%+005	-2 190E +003		ALL	5 2158 -003	1.5KE-005	2164E+003	9.4528+000	0
A.4.1	1.404E+004	-29998-005	-0.1438+005	-2.5038 -003		A.1.11	5.2156-003	1.5KE-005	1.4182-005	9.4528+000	0
A_4_11	1.4045+004	-2.999% +005	-1.3016+006	-2.5036 -003		ALL	5.7898+003	1.5166-005	42150-005	-2.9900-001	0 .
0.5.1	1.404E+004	2751E+005	1.3000+000	2.051E-000	-	-			-	1	110
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Section	16 (54)	YINI	M Pini	T (Tes)	laam'ool	AL1				-1.587E+005	
A.L.I	£ 507 E+004	13671+085	4.6271+004	1274E+302	12	AUT			21996+105		
A_1_11	£.40%E+004	1.5325+095	1.7975+005	1.2715+002	12	ALL			£45/E+905		
A.4.1	E.058E+004	1.5325+005	4.510E+005	0.706E +002	12 .	A.4.11			10425-006		
						13.2	-7.9600 +004	27825-005	1.0052 -005	5.4405-054	



Design calculations and results output

Design calculations covering ULS bending, stress, shear and interaction; SLS stress, web breathing and fatigue checks for main members and connectors are carried out rapidly. Multiple sections with different properties (haunches, stiffeners, etc) can be considered, as can bolted connections. Results, output in tabbed dialogs, visually show values that pass or fail. Graphs and a report containing all input data and output with references to the Eurocode clauses can be easily created.

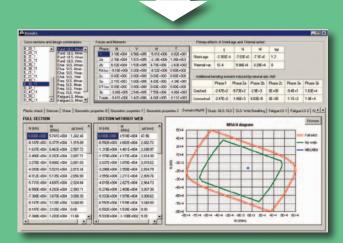
Easy-to-access results

A multi-tabbed results dialog gives access to the results for each of the design checks made for each deck section.



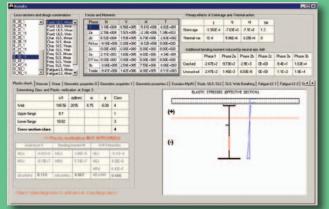
Descriptive graphics

Emphasis is on descriptive graphics as, for example, shown by a bending-shear interaction diagram showing web contribution included or excluded.



Crack checking

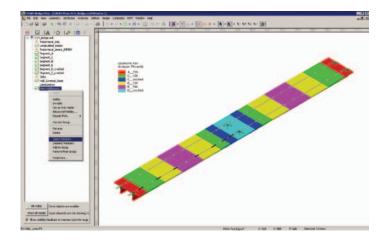
Where required, reinforced concrete crack width limitation can be carried out using the indirect method according to EN 1994-2 7.4 (3).



At-a-glance viewing of pass / fail values

Results summary tables values show (as do other results tables) colour coded values for those sections that pass or fail a particular design check.

ndamental		obination		-					С	haraoteristic	SLS co	mbination		-
Section	× mi	Combination	Oato Ph.1	Oan Ph.3	VECHI	syed	VEON	nd É		Sectors	X	Continuation	Sigid /Sig anm	vEd (KanP
0 50 11	53.414	Fund ULS Mass	4	4	1.041		0.705			A.U.	0.310	Disract SLS. M.	0.245	0.404
C 46 11	45.441	Fund ULS Minar	1	4	173	1.87	0.645	-11		A.1.1	0.110	Durant SLS. M.	0.134	0.061
0 50 11	53.414	Fund ULS Vinas	1	4	1111	1.00	0.743	- 1		A.1.1	0.210	Charact SLS.V.	0.000	0.000
D.50.11	43.630	Find ULS Maar	1	-	178	1.00	0.612	-11		AU	0.310	Charact SLS, Visin	0.313	0.517
C.46.1	45.205	Fund ULS Minor	1	4	100	1.000	0.003	- 1		A.U.II	0.966	Charact SLS. M.	0.097	0.083
	43.005		-	4		1.000	0.005	- 1		A.1.11	0.066	Charact SLS. M.	0.311	0.51
0_00_1		Fund ULS Viren	4		(74)					A.L.II	0.966	Charact SLS, V.,	0.097	0.083
C.46.11	41.441	Funt ULS Viran	4	4	16.0	1.82	0.95	1		A.1.11	0.966	Charact SLS. Visin	0.313	0.617
D_47_11	47.012	Fund ULS. Mines	4	4	660)	0.957	0.54	1		A.4.1	2.542	Charact SLS. M.	0.123	0.0%
C 44 11														
	44.078	Fund ULS Minan	4	4	(59)	0.947	0.535	1		A.4.1	2.542	Distant SLS. H	0.336	0.562
8 20 11	44.078 20.238	Fund ULS Minas Fund III C Minin	1	1	8.71	1 10071	01	H		4.63	2.542	Charact SLS. M.	0.336	0.562
	212%			1	6 71	Skala	Ranae	-		A.4.1 requent SLS	1.000		Veb	
igue comb	20.2%	Find III C Main	4	1	a 71	1 10071	01	j	-	requent SLS	combin	stion		
ligue comb	21 219	Einvil III C Main Combriation	A Studi	1	A 21	Stats Eta3	R 1	Parc.=	-	requent SLS	combine X	ation Continuation	Veb	
ligue comb Sector	20 21%	Erevt III C Main Combination FaligueLS, Minas	4 Studi 1111 0.232	1	6 71 Buds 01 0	Studs Eta3 0.232	Range Note	Parc + to		sector	combine X Imi	Stion Continuion Freq SLS, Minae	Vieb breathing 0.254	
ligue comb Sector	20.2%	Combination Folgue LS, Minas Folgue LS, Minas	4 Studi 1111 0.292	1	6 71 Buds 152 01 0 01 0	Studs Eta3 232 232	Range top 0.005	Par + b0 0.00		Eeston	combine X Imi 0000 0000	Stices Continuiton Freq SLS, Minas Freq SLS, Mina	Vieb beestrang 0.254 0.236	
li 30 11 Igue comb Serier UUI	21 21%	Ernet III C Main Combination Fatigue LS, Meas Fatigue LS, Mean Fatigue LS, Vinas	4 Sudi 0.232 0.232 0.309		6 71 Rude 152 01 0 005 0 005 0	Studs Eta3 0.232 0.232 0.307	Range 500 0.005 0.005	Pan bo 0.00 0.00		Eeston	Combine X bei 0.070 0.070 0.070	Continuation Freq SLS, Minute Freq SLS, Minute Freq SLS, Vinae	Vieb breathing 0.354 0.236 0.137	
li an 11 Iigue comb Senter A.1.1 A.1.1 A.1.1	20 276 Dination 20 276 20 276 20 20 20 20 20 20 20 20 20 276 20 20 20 20 20 20 20 20 20 20 20 20 20	Ered III C Main Continuation FalgueLS, Mean FalgueLS, Main FalgueLS, Vinin	4 Sudi 111 0.252 0.252 0.305 0.309	1	6 21 huds (142 01 1 005 0 005 1 005 1 012 1	Stude Eta3 0.232 0.307 0.307	Range top 0.005 0.005 0.005	Par - bo 0.00 0.00 0.00		Tequent SLS Lector. AU AU AU AU AU AU	Combine X Imi 0000 0000 0000 0000 0000	Sticell Continuation Fring SLS, Minutes Fring SLS, Vision Fring SLS, Vision	Vieb booting 0.254 0.236 0.137 0.234	
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igue comb Senter US AUS AUS AUS AUS AUS AUS AUS AUS AUS	20 214 21 214	Ered III C Main Contention Fatgue LS, More Fatgue LS, Main Fatgue LS, Vinas Fatgue LS, Vinas Fatgue LS, Minin Fatgue LS, Minin	4 Studi 5141 0.252 0.252 0.305 0.305 0.304	1 8 8 8 8 8 8 8 8 8 8 8 8 8	8 21 hub 192 01 1 009 1 009 1 012 1 012 1	54.ds 81a3 0.232 0.307 0.307 0.307 0.305 0.305	Range 100 0.005 0.005 0.005 0.005 0.005 0.000	Parx = 100 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	P. C.	Lecton AU AU AU AU AU AU AU	Combine 8 0.070 0.070 0.070 0.070 0.086	Stion Continuiton Freq SLS, Moan Freq SLS, Vinas Freq SLS, Vinas Freq SLS, Vinas Freq SLS, Mean	Vieb breathing 0.254 0.256 0.137 0.234 0.137 0.230	
igue comb Serier US AU3 AU3 AU3 AU3 AU3 AU3 AU3 AU3 AU3 AU3	20 21% 20 21% 20 21% 20 210 20 210 20 210 20 210 20 210 20 21% 20 21% 20% 20% 20% 20% 20% 20% 20% 20% 20% 20	Ered III C Main Castienation Futgue LS, Mass Futgue LS, Mass Futgue LS, Vinas Futgue LS, Vinas Futgue LS, Mass Futgue LS, Mass Futgue LS, Mass	4 Sudi 111 0.232 0.305 0.305 0.305 0.304 0.304	1	8 21 hide 112 01 1 005 1 005 1 012 1 012 1 012 1 012 1	54.ds 85a3 0.232 0.307 0.307 0.307 0.305 0.308	Range top 0.005 0.005 0.005 0.005 0.005 0.000 0.000 0.000	Parx = 100 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	P. C.	Easten AU AU AU AU AU AU AU AU AU AU	Combine X Int 0.010 0.010 0.010 0.010 0.010 0.010 0.016 0.066 0.086	stion Cordinaton Freq SLS, Mraja Freq SLS, Wain Freq SLS, Wain Freq SLS, Mraja Freq SLS, Mraja Freq SLS, Mraja	Vieb breathing 0.254 0.157 0.236 0.157 0.230 0.157	
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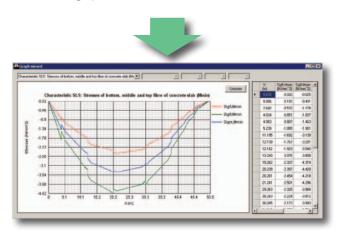




Results output (cont.)

Graphing of results

Pre-defined graphs of utilisation factors, stresses, longitudinal shear per unit length, force and moments, etc. are easily plotted. User-defined graphs can also be created.



Reports

Reports, containing all or selected input and results data, are created with references to Eurocode clauses.



Bridge types supported

- Composite I-girders
- Composite tub girders
- Composite box girders
- Orthotropic steel decks
- Half-through girder bridges

The Steel and Composite Deck Designer provides automated ULS, SLS, fatigue and other calculations:

- Section properties
- Primary (isostatic) effects of shrinkage and temperature change
- Creep and shrinkage coefficients (EN1992-1-1, App B)
- Classification of sections (EN1993-1-1, Table 5.2)
- Ultimate bending check for Class 1 and 2 sections (EN1993-1-1, 6.2.5)
- Stress checks for Class 3 and Class 4 sections (EN1993-1-5, Section 4)
- Ultimate shear and web buckling (EN1993-1-5, Section 5)
- Shear lag and /or the buckling of longitudinally stiffened flanges is considered
- Bending-shear interaction (EN1993-1-5, Section 7)
- SLS stress checks (EN1994-2, 7.2.2 (5) and EN1993-2, 7.3)
- SLS web breathing check (EN1993-2, 7.4)
- Reinforced concrete cracking checks (EN1994-2, 7.4 (3))
- ULS, SLS and fatigue checks for connectors (EN1994-2, 6.6 and 6.8)
- ULS, SLS bolted connections (EN 1993-1-8)
- Fatigue checks for both structural steel and reinforcement components (EN 1993-1-9, EN 1994-2, EN 1993-2)
- Transverse and longitudinal stiffener checks (EN 1993-1-5, 9.2.1 and 9.3.3)

LUSAS

All bridge images are of structures designed or assessed using LUSAS Bridge software / options. Issue 1.

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