

PontiEC4

Steel and steel-concrete composite bridge decks Eurocode design calculations

PontiEC4 is a standalone software program carrying out comprehensive calculations to the Eurocodes for grillage and box decks with composite or steel sections also including stiffened flanges as orthotropic plate. The software deals with cross references in Eurocode suite, that make design calculations time-consuming and error-prone without use of PontiEC4.

The user enters moments and shears from an analysis model, dimensions and selects material data from a library. PontiEC4 carries out design calculations covering ULS bending, stress, shear and interaction; SLS stress, web breathing and cracking and fatigue checks for main members and connectors. Output uses intuitive graphics and tables and a report is produced automatically in rtf format.

Rapid and well-structured input

Input is designed to be rapid, using graphics together with Excel spreadsheet-style for design envelopes of stress resultants; PontiEC4 has a direct interface to LUSAS Modeller and format conversion of design results for other FE systems is achieved in Excel.

A library of steel & concrete material properties makes input rapid, while retaining full flexibility for the user to tweak parameters to suit project requirements.

The screenshot displays the 'Geometry' dialog box in the software. On the left, there are input fields for structural steel properties: bs (mm) 1100, ts (mm) 50, hmet (mm) 2700, twr (mm) 16, alpha 12, bi (mm) 1200, and ti (mm) 70. There are also checkboxes for 'Top flange in Class 1', 'Top flange <40mm', 'Web stiffeners', 'Inclined web', and 'Bottom flange <40mm'. On the right, there is a diagram of a composite section with dimensions: bcs, b1, bs, ts, h1, h2, twr, alpha, hcop, and hmet. Below the diagram, there are input fields for slab concrete properties: bcs (mm) 6311.5, tcls (mm) 273, b1 (mm) 1200, bsx (mm) 2875.2875, hcop (mm) 75, and 'Consider haunch'. At the bottom right, there is a tree structure of sections: A, C, 46_1, 46_11, 41_1, 41_11, 10_1, 10_11, 7_1, 7_11, 8_1, 8_11, 5_1, 5_11, B, E, D, 4_1, 4_11, 3_1, 3_11.

Sections are described by the engineer in a simple dialog box and organized in a tree structure

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

ULS fund., Mmax

PHASE 1. Selfweights				
Section	N (N)	V (N)	M (Nm)	T (Nm)
A_48_1	4.208E+004	-1.392E+006	7.223E+004	7.511E+001
A_48_11	3.117E+004	-1.025E+006	-8.468E+005	5.564E+001
A_47_1	3.115E+004	-8.713E+005	-2.521E+006	6.922E+001
A_47_11	3.115E+004	-8.618E+005	-3.755E+006	6.922E+001
C_46_1	3.115E+004	-7.985E+005	-3.750E+006	7.395E+001

PHASE 2A. Permanent loads (non-structural bridge equipments)				
Section	N (N)	V (N)	M (Nm)	T (Nm)
A_48_1	9.672E+003	-4.757E+005	1.046E+004	-3.176E+003
A_48_11	7.165E+003	-3.523E+005	-3.007E+005	-2.353E+003
			76E+005	-8.672E+005
			76E+005	-1.291E+006
			28E+005	-1.290E+006

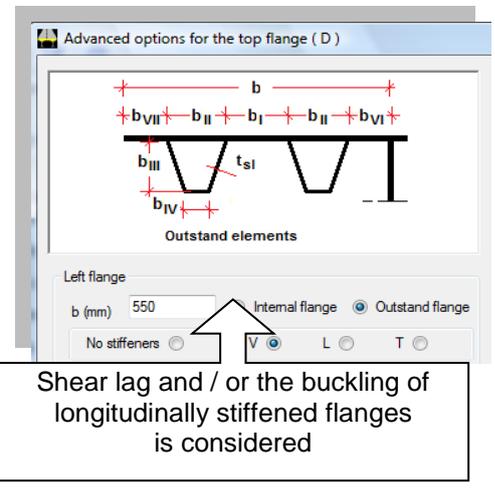
PHASE 2C. Imposed deformations/prestressing				
Section	N (N)	V (N)	M (Nm)	T (Nm)
A_48_1	0.000E+000	0.000E+000	0.000E+000	0.000E+000
A_48_11	0.000E+000	0.000E+000	0.000E+000	0.000E+000
A_47_1	0.000E+000	0.000E+000	0.000E+000	0.000E+000
A_47_11	0.000E+000	0.000E+000	0.000E+000	0.000E+000
C_46_1	0.000E+000	0.000E+000	0.000E+000	0.000E+000

PHASE 3A. Thermal actions					
Section	N (N)	V (N)	M (Nm)	T (Nm)	(gam/psi) Eff. Isost.
A_48_1	5.688E+003	1.710E+005	2.385E+003	1.433E+001	0
A_48_11	5.688E+003	1.710E+005	1.521E+005	1.433E+001	0
A_47_1	6.268E+003	1.710E+005	4.518E+005	-3.911E+001	0

PHASE 3B. Traffic loads					
Section	N (N)	V (N)	M (Nm)	T (Nm)	(gam/psi) Eff. Isost.
A_48_1	1.515E+005	-1.856E+006	1.264E+005	-1.721E+005	
A_48_11	-3.486E+004	2.880E+005	2.185E+005	4.545E+004	
A_47_1	-7.134E+004	2.815E+005	6.905E+005	5.681E+004	
A_47_11	-7.134E+004	2.815E+005	1.091E+006	5.681E+004	
C_46_1	-7.134E+004	2.809E+005	1.085E+006	5.716E+004	

Automated ULS, SLS & fatigue calculations

- Section properties
- Primary (isostatic) effects of shrinkage and temperature change
- Creep & shrinkage coefficients (EN1992-1-1, App B)
- Classification of sections (EN1993-1-1, Table 5.2)
- Ultimate bending check for Class 1 & 2 sections (EN1993-1-1, 6.2.5)
- Stress checks for Class 3 & Class 4 sections (EN1993-1-5, Section 4)
- Ultimate shear & web buckling (EN1993-1-5, Section 5)
- Bending-shear interaction (EN1993-1-5, Section 7)
- SLS stress checks (EN1994-2, 7.2.2 (5) & EN1993-2, 7.3)
- SLS web-breathing check (EN1993-2, 7.4)
- RC crack checks (EN1994-2, 7.4.2)
- ULS, SLS and fatigue checks for connectors (EN1994-2, 6.6 & 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)
- Longitudinal and transversal stiffeners check (EN 1993-1-5, 9.2.1, (4), (8), (9), 9.3.3 (3))



Output & reporting

A multi-page form gives the summary results from the checks for each section.

Phase	N	V	M	T
1	4.20E+004	2.22E+006	1.74E+007	-1.02E+002
2a	-2.96E+004	7.13E+005	4.77E+006	7.78E+001
2b	-4.28E+003	1.82E+005	8.47E+006	7.58E+000
Rit.Iso	0.00E+000	0.00E+000	0.00E+000	0.00E+000
2c	0.00E+000	0.00E+000	0.00E+000	0.00E+000
3a	-1.08E+004	1.71E+005	7.93E+006	7.59E+001
DT.Iso	0.00E+000	0.00E+000	0.00E+000	0.00E+000
3b	-2.64E+005	1.26E+006	1.46E+007	-1.78E+002
Totale	-2.66E+005	4.55E+006	5.31E+007	-1.94E+002

	ϵ	N	M	γ_w
Shrinkage	-3.366E-4	-7.56E+6	-7.04E+6	0
Thermal var.	1E-4	5.8E+6	3.61E+6	0

	Phase 1	Phase 2a	Phase 2b	Phase 2c	Phase 3a	Phase 3b
Cracked	-9.69E+2	9.62E+2	1.39E+2	0E+00	3.5E+2	8.56E+3
Uncracked	-9.69E+2	9.74E+2	1.39E+2	0E+00	2.87E+2	7.02E+3

	c/t	zpl(mm)	α	ν	Class
Web	161.25	2459	0.93	-0.96	4
Upper flange	10.84				1
Lower flange	8.46				3

Cross-section class

=> Plastic verification NOT APPLICABLE

	Axial force N	Bending moment M	N-M Interaction
NEd	-2.66E+5	5.31E+7	NEd
NRd	-1.11E+8	9.42E+7	MRd
NEd/NRd	0.002	0.564	MEd/MRd

Phase 1: Upper flange class=1, Web class=1, Lower flange class=3

A report is produced automatically in rtf format, containing all input data and output with references to the Eurocode clauses.



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