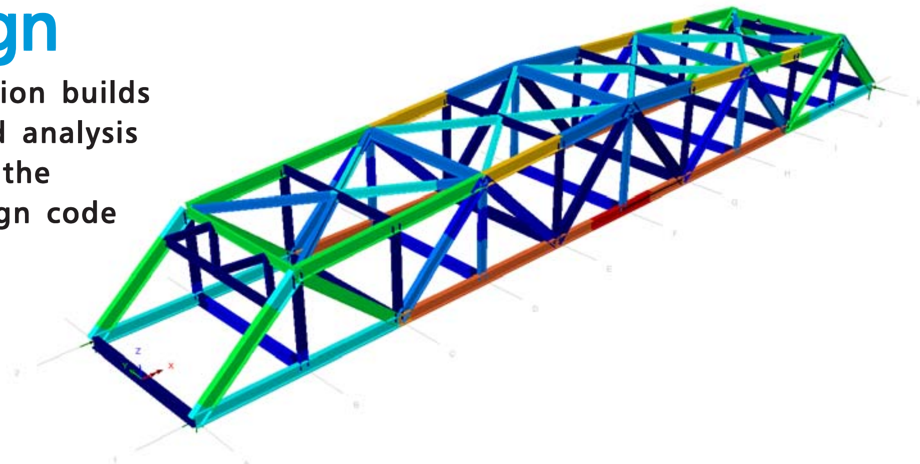
software option

Steel Frame Design

The LUSAS Steel Frame Design option builds upon the renowned modelling and analysis capabilities of LUSAS and extends the engineer's workflow to allow design code checking of steel members.



In some finite element software systems, sectional design is offered through summary pass/fail checks on a model. Whilst LUSAS offers this, it also provides users with full details of the calculations made, referencing all relevant clauses and equations from a design code - giving a step-by-step calculation transparency normally only found in simple frame analysis software. Full details of design checks undertaken can also be written to a model report.

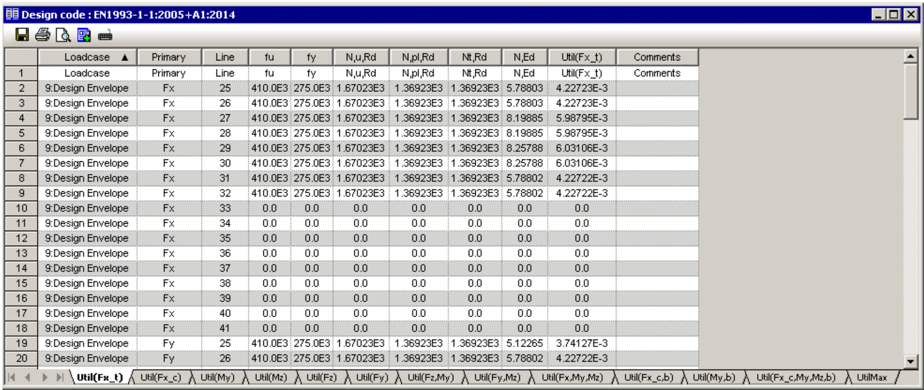
Design codes currently supported:

- AASHTO LRFD 7th Ed. (2014)
- AASHTO LRFD 8th Ed. (2017)
- ANSI/AISC 360-16
- AS 4100-1998
- CSA S6-14
- EN1993-1-1+A1:2014
- EN1993-2: 2006
- GB50017-2017

Design summary reports

Produce a tabular summary of design check results for selected members and loadcases. Save results for use with Microsoft Excel or save to a text format.

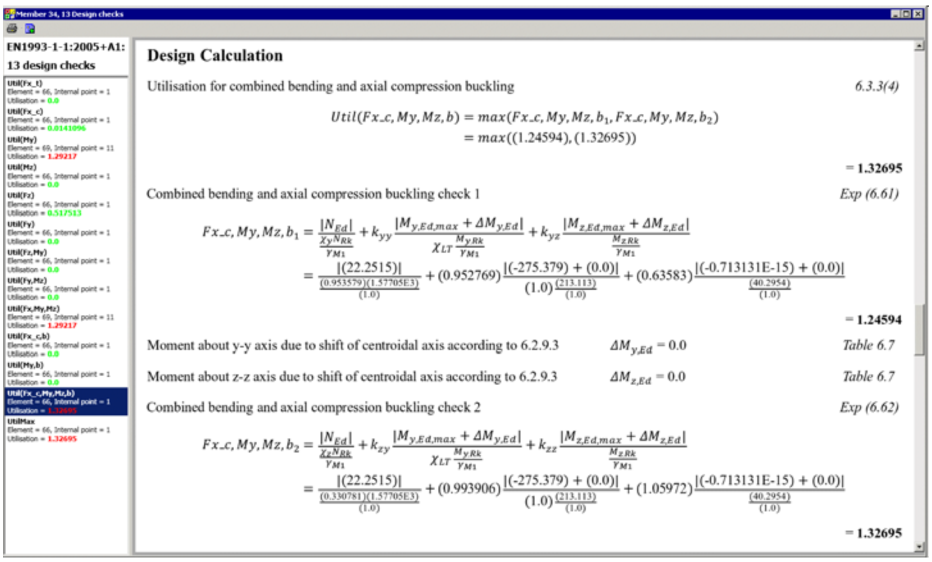
Add results to a model report, and each time the report is generated design summary data will be updated to match the current state of the model.



Design code : EN1993-1-1:2005+A1:2014

	Loadcase ▲	Primary	Line	fu	fy	N,u,Rd	N,pl,Rd	Nt,Rd	N,Ed	Util(Fx_t)	Comments
1	Loadcase	Primary	Line	fu	fy	N,u,Rd	N,pl,Rd	Nt,Rd	N,Ed	Util(Fx_t)	Comments
2	9:Design Envelope	Fx	25	410.0E3	275.0E3	1.67023E3	1.36923E3	1.36923E3	5.78803	4.22723E-3	
3	9:Design Envelope	Fx	26	410.0E3	275.0E3	1.67023E3	1.36923E3	1.36923E3	5.78803	4.22723E-3	
4	9:Design Envelope	Fx	27	410.0E3	275.0E3	1.67023E3	1.36923E3	1.36923E3	8.19885	5.98795E-3	
5	9:Design Envelope	Fx	28	410.0E3	275.0E3	1.67023E3	1.36923E3	1.36923E3	8.19885	5.98795E-3	
6	9:Design Envelope	Fx	29	410.0E3	275.0E3	1.67023E3	1.36923E3	1.36923E3	8.25788	6.03106E-3	
7	9:Design Envelope	Fx	30	410.0E3	275.0E3	1.67023E3	1.36923E3	1.36923E3	8.25788	6.03106E-3	
8	9:Design Envelope	Fx	31	410.0E3	275.0E3	1.67023E3	1.36923E3	1.36923E3	5.78802	4.22722E-3	
9	9:Design Envelope	Fx	32	410.0E3	275.0E3	1.67023E3	1.36923E3	1.36923E3	5.78802	4.22722E-3	
10	9:Design Envelope	Fx	33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
11	9:Design Envelope	Fx	34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
12	9:Design Envelope	Fx	35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
13	9:Design Envelope	Fx	36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
14	9:Design Envelope	Fx	37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
15	9:Design Envelope	Fx	38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
16	9:Design Envelope	Fx	39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
17	9:Design Envelope	Fx	40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
18	9:Design Envelope	Fx	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
19	9:Design Envelope	Fy	25	410.0E3	275.0E3	1.67023E3	1.36923E3	1.36923E3	5.12265	3.74127E-3	
20	9:Design Envelope	Fy	26	410.0E3	275.0E3	1.67023E3	1.36923E3	1.36923E3	5.78802	4.22722E-3	

Util(Fx_t) | Util(Fx_c) | Util(My) | Util(Mz) | Util(Fz) | Util(Fy) | Util(Fz,My) | Util(Fy,Mz) | Util(Fx,My,Mz) | Util(Fx_c,b) | Util(My,b) | Util(Fx_c,My,Mz,b) | UtilMax



Member 34, 13 Design checks

EN1993-1-1:2005+A1:

13 design checks

Design Calculation

Utilisation for combined bending and axial compression buckling — *6.3.3(4)*

$$Util(Fx\_c, My, Mz, b) = max(Fx\_c, My, Mz, b_1, Fx\_c, My, Mz, b_2) = max((1.24594), (1.32695))$$

= **1.32695**

Combined bending and axial compression buckling check 1 — *Exp (6.61)*

$$Fx\_c, My, Mz, b_1 = \frac{|N_{Ed}|}{\frac{\chi_y N_{Rk}}{\gamma_{M1}}} + k_{yy}\frac{|M_{y,Ed,max}+\Delta M_{y,Ed}|}{\chi_{LT}\frac{M_{y,Rk}}{\gamma_{M1}}} + k_{yz}\frac{|M_{z,Ed,max}+\Delta M_{z,Ed}|}{\frac{M_{z,Rk}}{\gamma_{M1}}} = \frac{|(22.2515)|}{\frac{(0.953579)(1.57705E3)}{(1.0)}} + (0.952769)\frac{|(-275.379)+(0.0)|}{(1.0)\frac{(213.113)}{(1.0)}} + (0.63583)\frac{|(-0.713131E-15)+(0.0)|}{\frac{(40.2954)}{(1.0)}}$$

= **1.24594**

Moment about y-y axis due to shift of centroidal axis according to 6.2.9.3 — $\Delta M_{y,Ed} = 0.0$ — *Table 6.7*

Moment about z-z axis due to shift of centroidal axis according to 6.2.9.3 — $\Delta M_{z,Ed} = 0.0$ — *Table 6.7*

Combined bending and axial compression buckling check 2 — *Exp (6.62)*

$$Fx\_c, My, Mz, b_2 = \frac{|N_{Ed}|}{\frac{\chi_z N_{Rk}}{\gamma_{M1}}} + k_{zy}\frac{|M_{y,Ed,max}+\Delta M_{y,Ed}|}{\chi_{LT}\frac{M_{y,Rk}}{\gamma_{M1}}} + k_{zz}\frac{|M_{z,Ed,max}+\Delta M_{z,Ed}|}{\frac{M_{z,Rk}}{\gamma_{M1}}} = \frac{|(22.2515)|}{\frac{(0.330781)(1.57705E3)}{(1.0)}} + (0.993906)\frac{|(-275.379)+(0.0)|}{(1.0)\frac{(213.113)}{(1.0)}} + (1.05972)\frac{|(-0.713131E-15)+(0.0)|}{\frac{(40.2954)}{(1.0)}}$$

= **1.32695**

Formatted member reports

Generate formatted member reports to investigate the design calculations carried out for particular members. These show all calculations made and reference clauses and equations from the code.

Create individual steel member design reports and optionally append to a main model report.

Define model report templates to speed reproduction of similar content.

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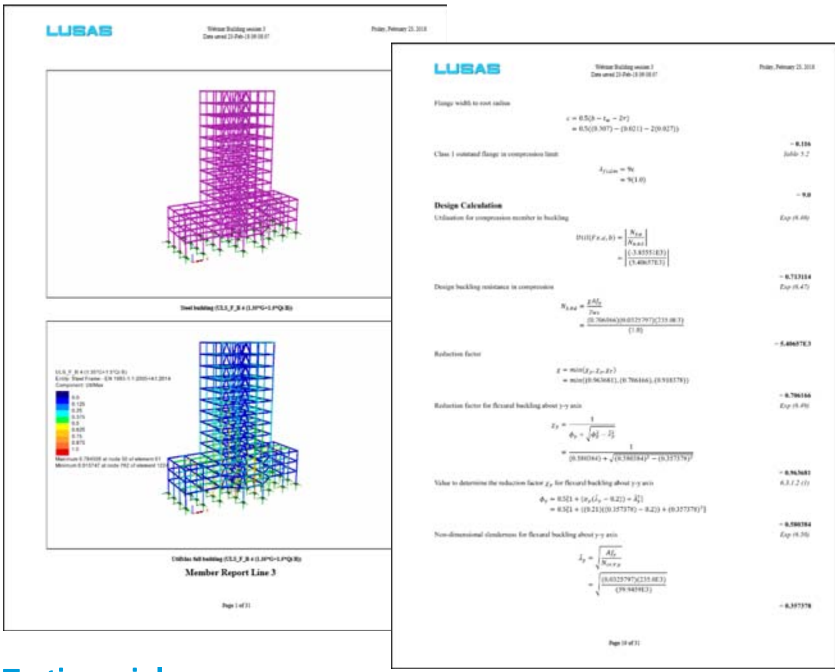
Typical report output



Testimonials

We used key clients to help assess the Steel Design option whilst it was in development. Read what benefits they see from testing the utility.

“One of the key benefits that we see in LUSAS’ new steel design capability is the provision of fully-detailed calculation output. This allows us to easily check the steps in the calculation. We are also pleased to see that the facility sits fully inside LUSAS, rather than as an external utility. This means it functions in a familiar way for the engineer as the rest of the modelling process.”

John Harrison, Structural Engineer, Reid International

“The new section checking facility is a valuable addition to the tools available in LUSAS, providing a convenient and very rapid way to verify steel frame structures. Time saved extracting results and setting up post-processing spreadsheets enables the engineer to focus on the nonlinear and dynamic behaviour aspects that LUSAS has always handled well. Output is available in convenient contour plots of utilisation, backed-up by detailed numerical hand calculation-style reports. This provides everything the user needs to interrogate and verify the implementation of the design codes, which is a welcome contrast to the 'black box' approach of some other software packages.”

Ben Curry, Senior Engineer, COWI

LUSAS

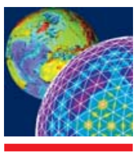
Finite Element Analysis

Steel Design Option

- Extend your workflow from analysis into detailed design.
- Say goodbye to “black-box” approaches that hide the calculations from the user and increase the difficulty of checking and submission.
- Don’t need the detail? Produce summary information instead in graphical, tabular and report-based formats and quickly see pass/fail criteria.
- Learn it fast. Existing users can easily apply the steel frame design option because it works in exactly the same way as other tools they have become familiar with.
- Create design reports individually or append them to the report for the whole model.
- Mix summary reports for the whole structure with detailed reports of critical members.
- Create templates to speed reproduction of similar content.

Design codes supported

- AASHTO LRFD 7th Edition (2014)
- AASHTO LRFD 8th Edition (2017)
- ANSI/AISC 360-16
- AS 4100-1998
- CSA S6-14
- EN1993-1-1+A1:2014 (Buildings)
- EN1993-2: 2006 (Bridges)
- GB50017-2017



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