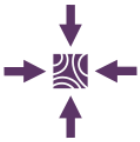
femto engineering

SDC VERIFIER


Load Combinations

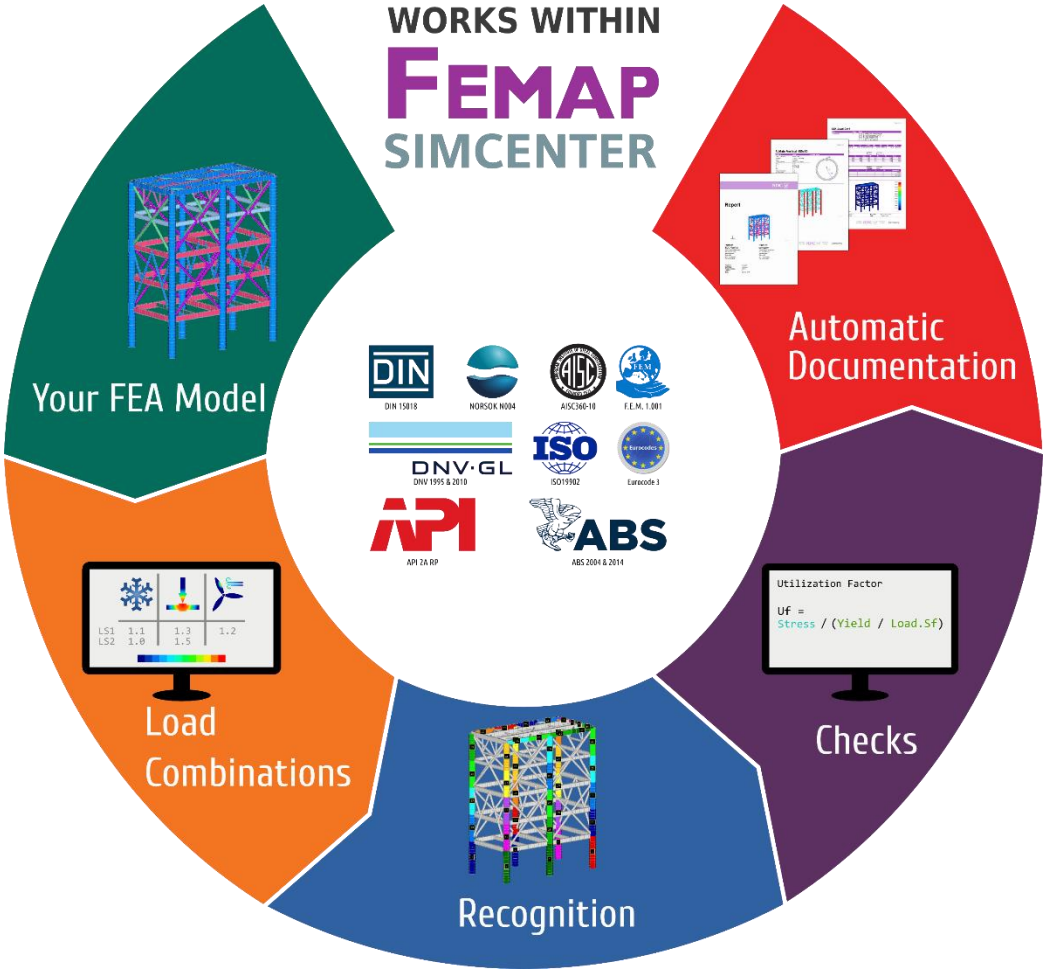

Recognition


Checks


Reports

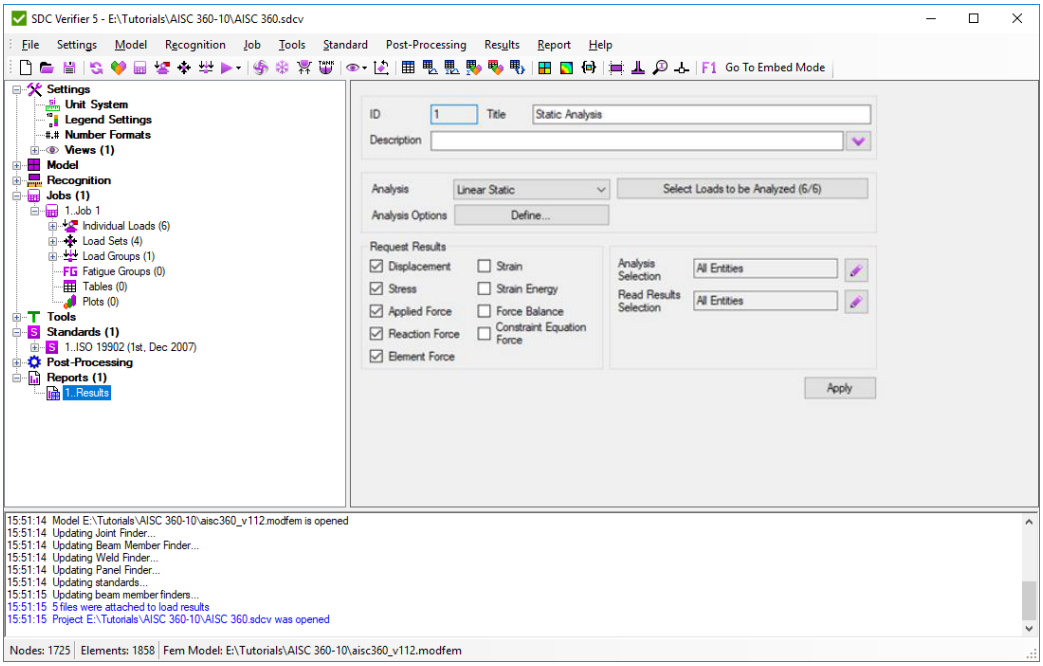
SDC Verifier

A powerful postprocessor extension for Femap and Simcenter3D which automates the full FEA workflow.

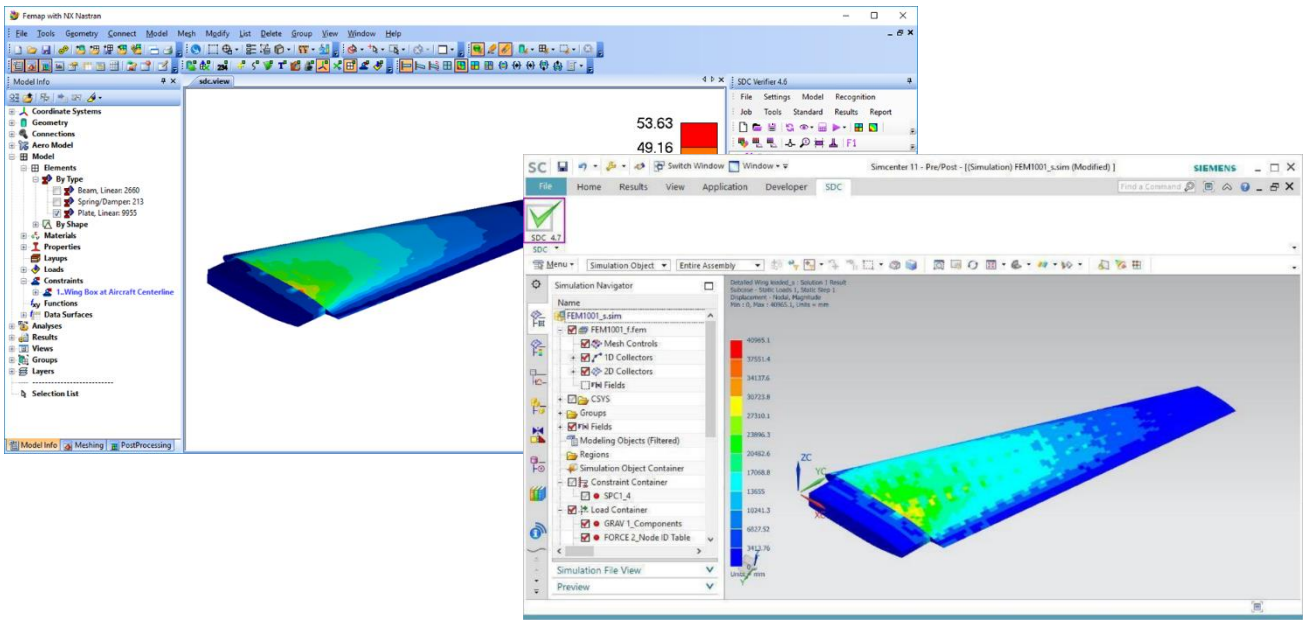


SDC Verifier works within Femap and Simcenter

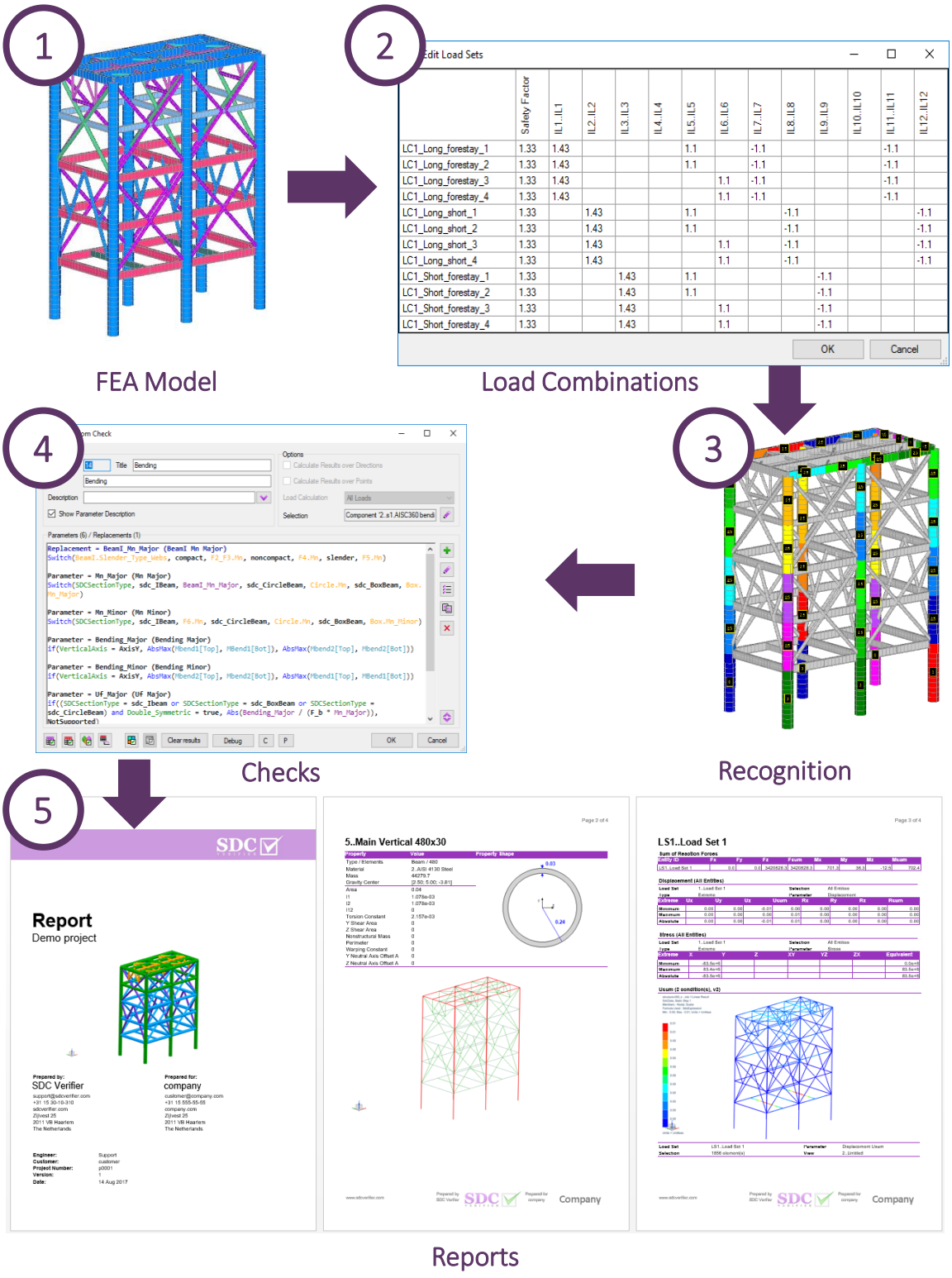
SDC Verifier is a powerful post-processor program that is used to verify structures in accordance with required safety standards and generate a report in an efficient and simple way.



Femap / Simcenter offers an advanced engineering analysis environment for simulation of complex engineering problems. SDC Verifier together with the CAE program makes the calculation procedure more transparent and facilitates checking of a complete set of load cases according to predefined design code rules or own standards. Full model description and all calculations are presented in reports. Consequences of updates to the design can be reviewed and compared with the original design using report regeneration.



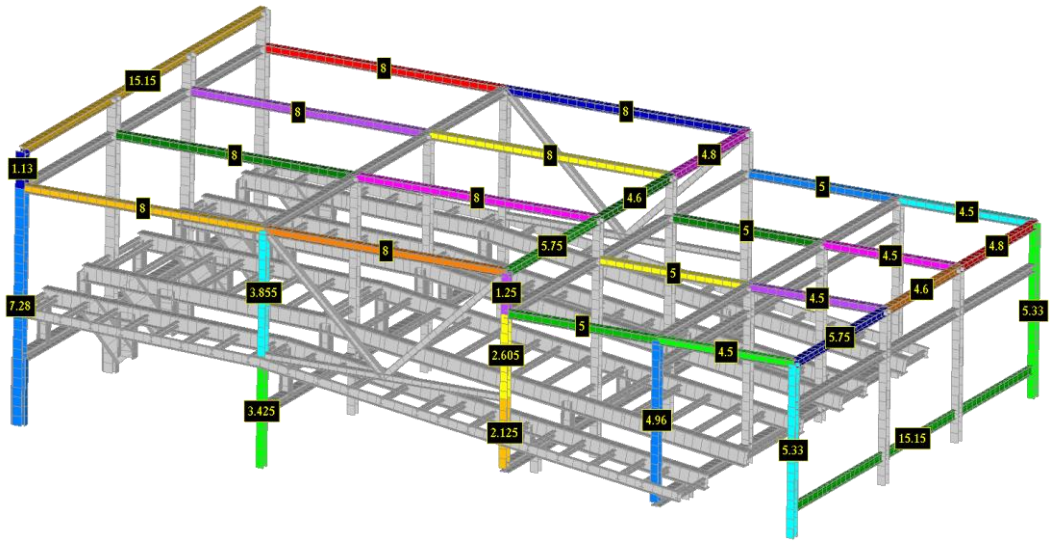
The complete verification procedure of the structure is stored. When the design is modified it requires only one-click on the “Regenerate” to rerun all the calculations and regenerate the report.



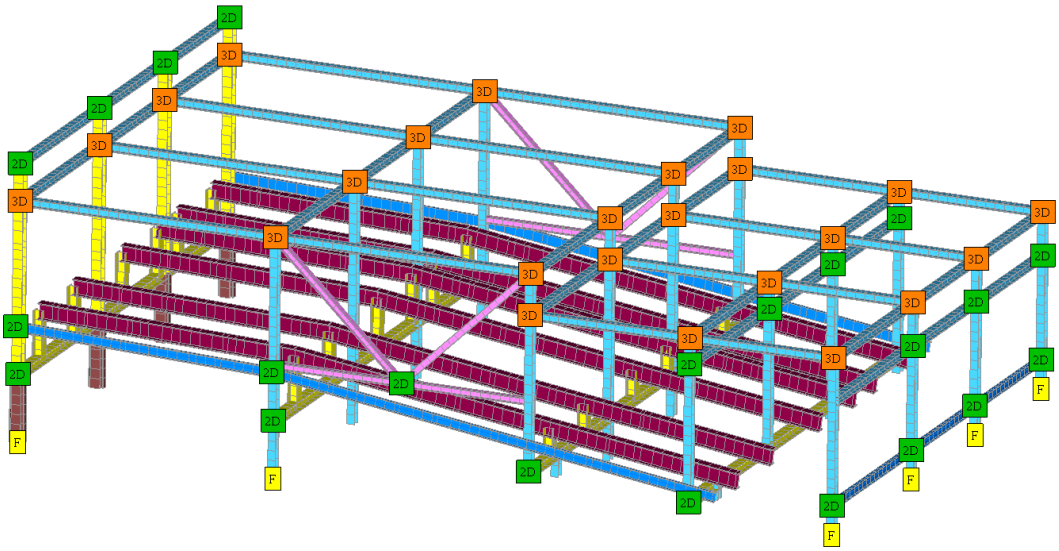
SDC Verifier implements the following standards for checking large (offshore) lattice structures: AISC/ANSI 360-10, API RP 2A, Eurocode3, ISO 19902 and Norsok N004.

AISC 360-10 | API 2A RP | ISO 19902 | Eurocode3 | Norsok N004

Beam Member Finder recognizes beam members (buckling) lengths automatically for 3 directions (Y, Z and torsional)

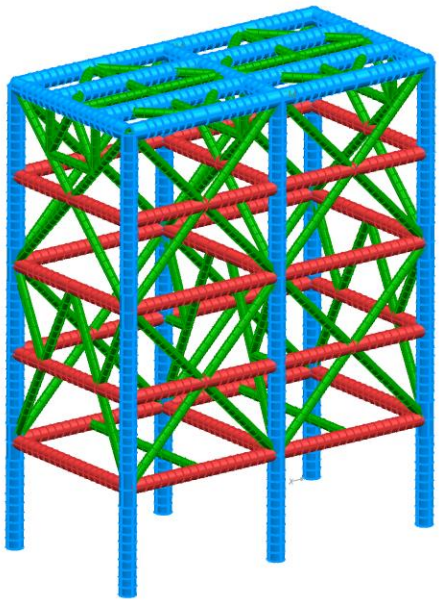


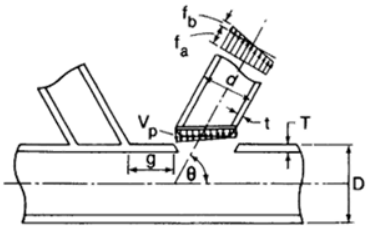
Buckling length is calculated between the Joints and does not depend on the model mesh.

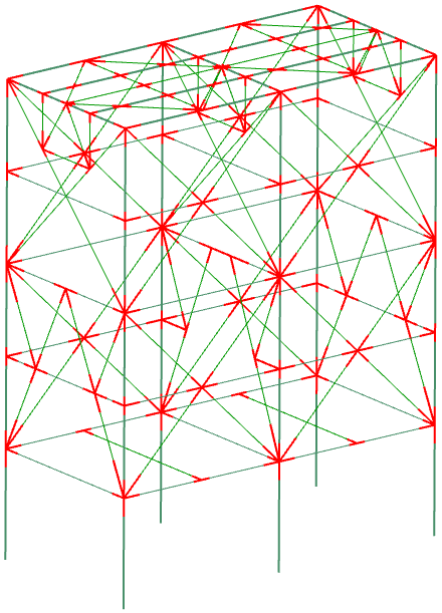


Verification of the tubular joints is performed by Joint Check according to the following standards: API RP 2A, Eurocode3, ISO 19902 and Norsok N004.

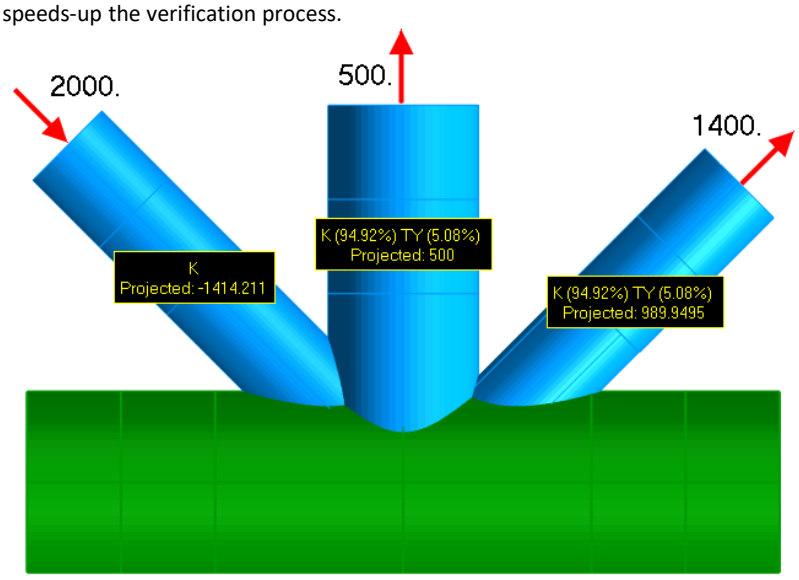
API 2A RP **ISO 19902** **Norsok N004**

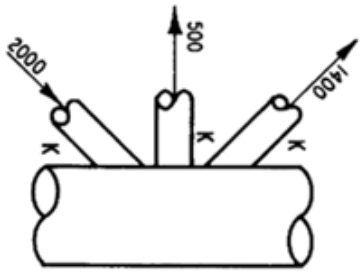






Brace classification (depends on the load pattern) is calculated for each load situation automatically, which significantly speeds-up the verification process.





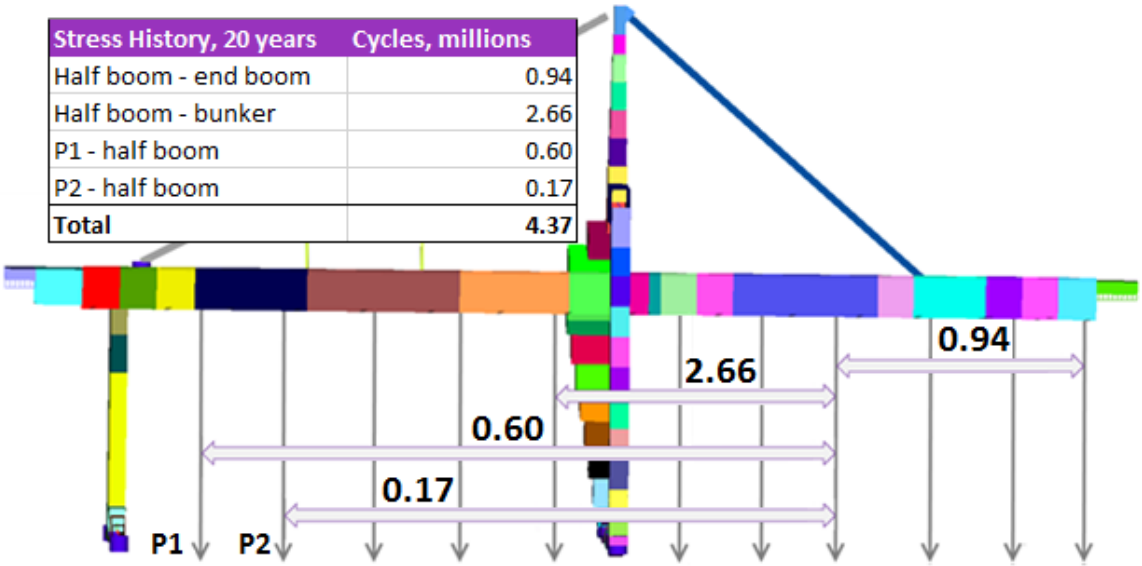
Connection ID	Brace Number	Joint Type
1	#1 (ElemID = 27)	K
	#2 (ElemID = 13)	K (94.92%) TY (5.08%)
	#3 (ElemID = 19)	K (94.92%) TY (5.08%)

Fatigue is a progressive structural damage of materials under cyclic loading. SDC Verifier implements the following standards (based on the Palmgren-Miner S-N curves): Eurocode3, F.E.M 1.001 and DIN 15018.

Eurocode3 **DIN 15018** **F.E.M. 1.001**

The fatigue damage method is based on different loading patterns (stress history) and calculates fatigue life consumption for each cycle based on the stress variation and the number of load cycles.

Stress History, 20 years	Cycles, millions
Half boom - end boom	0.94
Half boom - bunker	2.66
P1 - half boom	0.60
P2 - half boom	0.17
Total	**4.37**

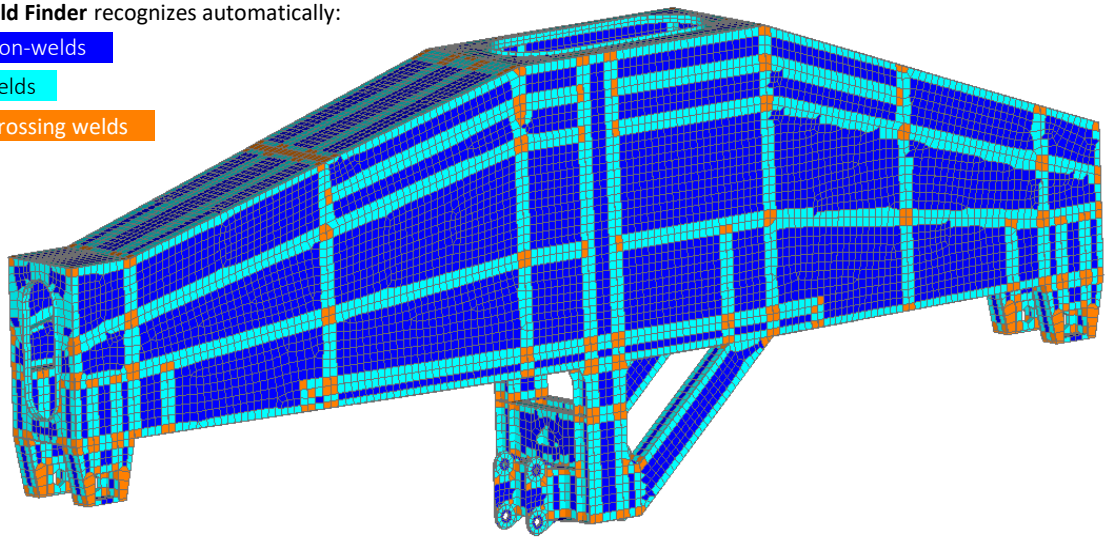


Weld Finder recognizes automatically:

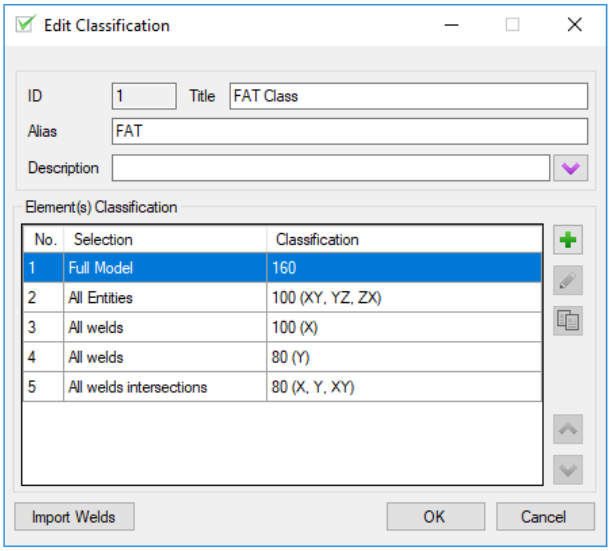
non-welds

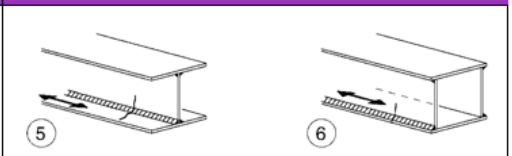
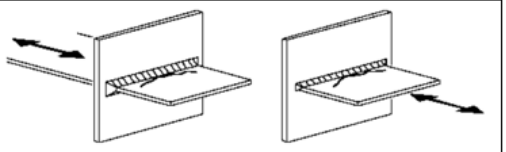
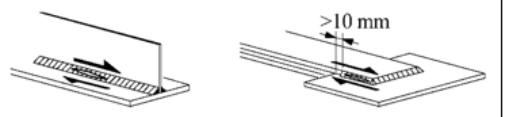
welds

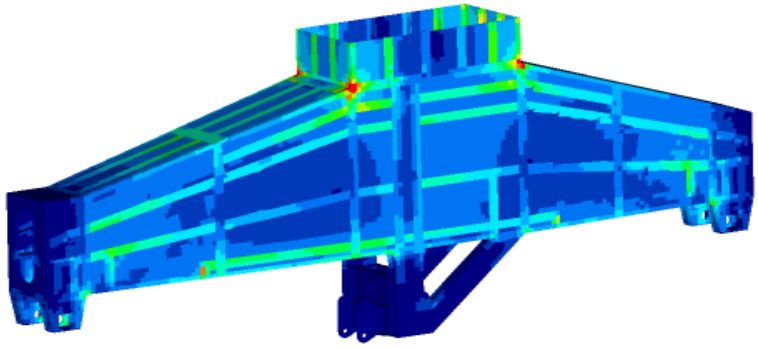
crossing welds

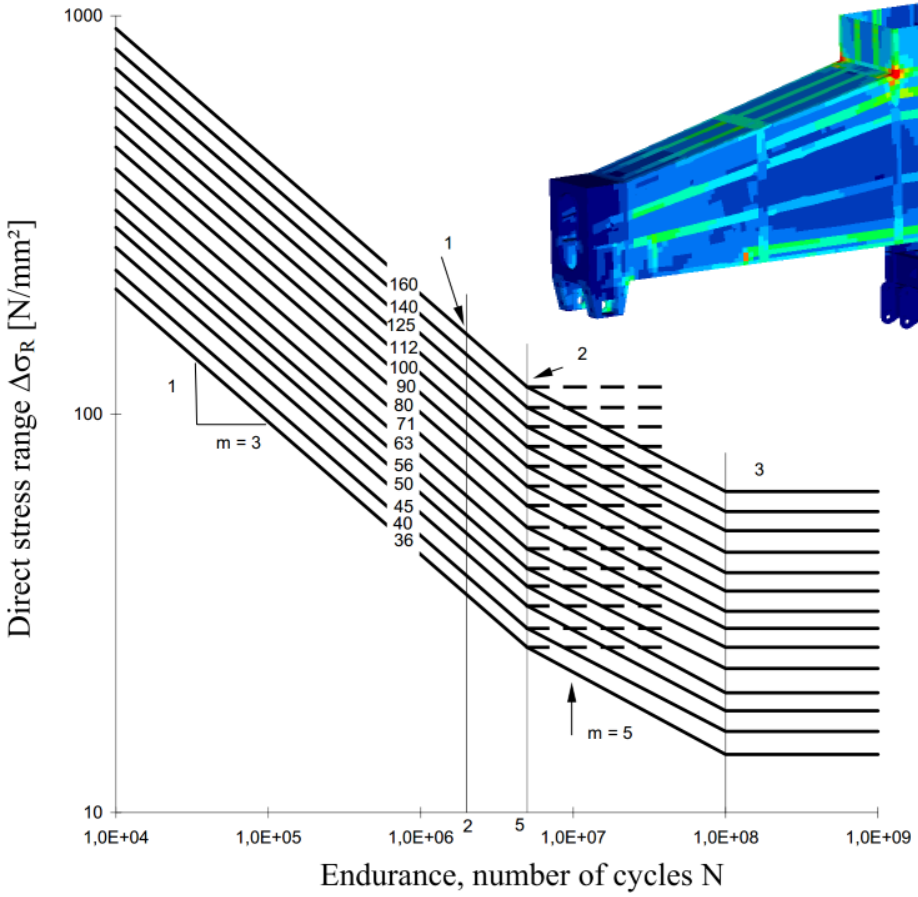


The notch group classification or fatigue strength of the welds depends on the quality and the stress direction, along the weld (X), perpendicular to the weld (Y) and the shear (XY). Stresses are converted into weld direction automatically by weld finder.

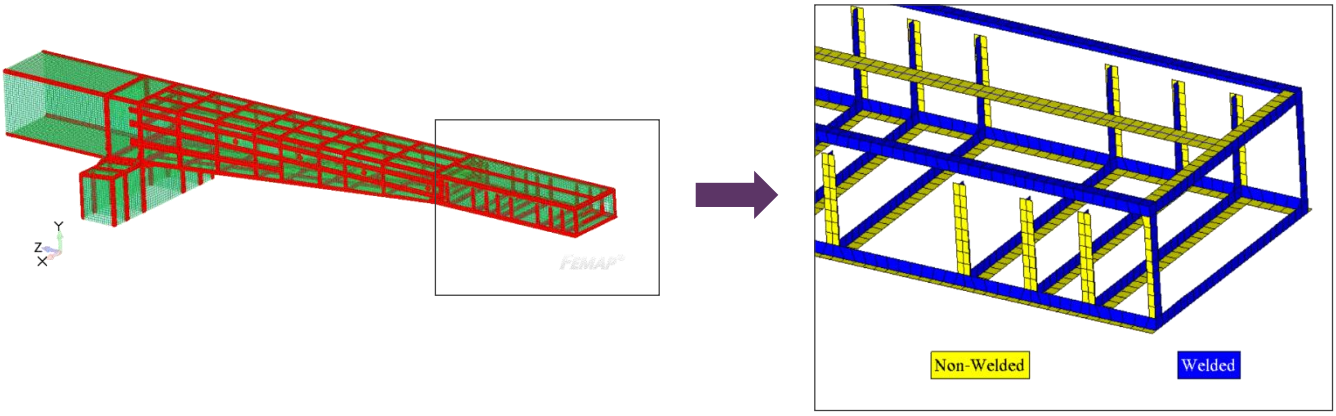


Detailed Category	Constructional detail
100	
80	
80	





SDC Verifier performs a strength check according to DNV-OS-C101/C201. The Weld Finder tool automatically recognizes which plate is welded.



The forces/moments of each element of the weld are summarized into the local weld coordinate system:

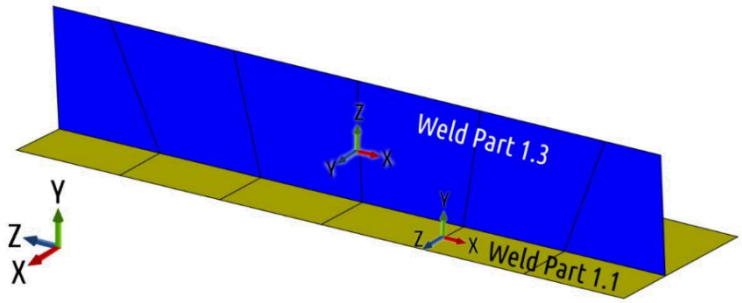
Weld Force Summation

Individual Load: 1..Gravity

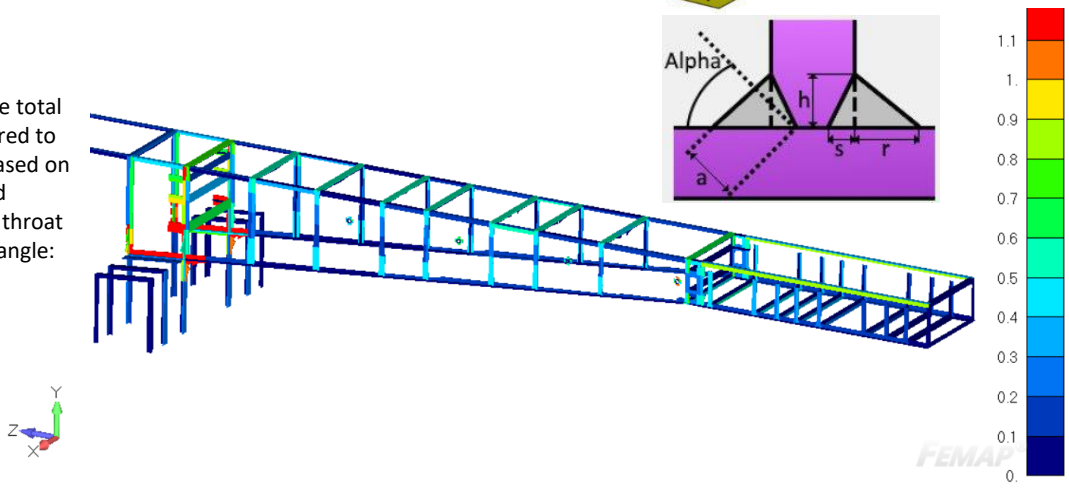
Plot Direction: Fx

Plot

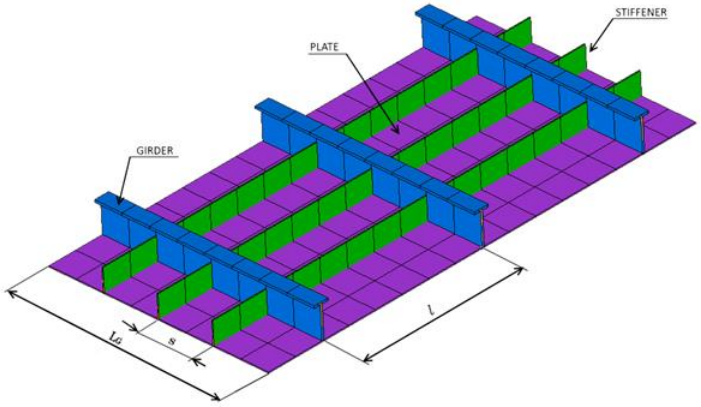
Weld Part	Welded	Csys	Fx	Fy	Fz	Mx	My	Mz
Weld Part 1.1 [-29.6; 12.27; 2.73]	No	Rotation [-180; -90; -1...	182.52	7.98	23.37	-0.34	1.81	0.17
Weld Part 1.2 [-29.6; 12.27; 2.73]	No	Rotation [-180; 90; -1...	8.87	-2.75	0.21	0.07	0.25	0.02
Weld Part 1.3 [-29.6; 12.27; 2.73]	Yes	Rotation [-90; 0; 90]	-221.47	-2.60	4.96	0.26	-5.45	-0.23
Weld Part 2.1 [-29.6; 12.27; 2.99]	No	Rotation [-180; -90; 0]	281.55	1.51	-8.05	-0.06	5.84	0.13



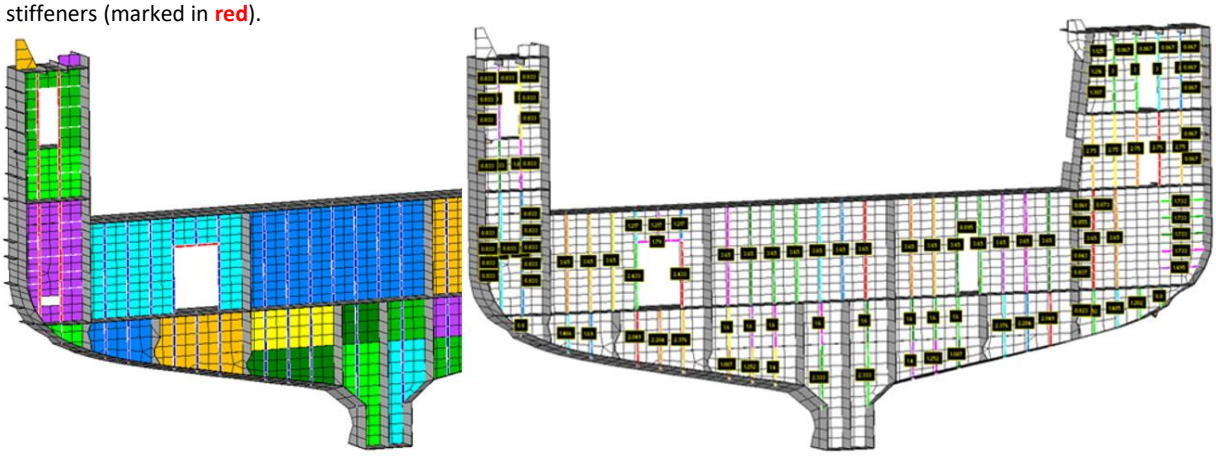
The load on the total weld is compared to the capacity based on the length, and parameters as throat thickness and angle:



Stiffened Panel Finder — recognizes automatically sections, panels, plates, stiffeners and girders and their dimensions. This tool is an advanced version of the Panel Finder.



In the figure below are plotted: panels, simple stiffeners (marked in blue) and girders or stiffeners which support also other stiffeners (marked in **red**).



Effective Width — calculate plate effective width for every load situation. Effective width is used in stiffener buckling check according to DNV-RP-C201 2010:

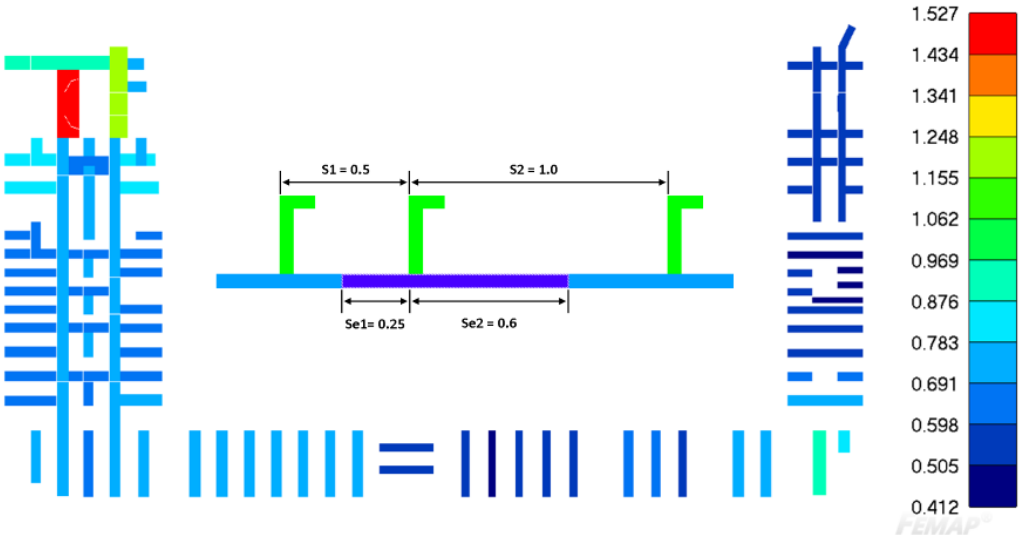
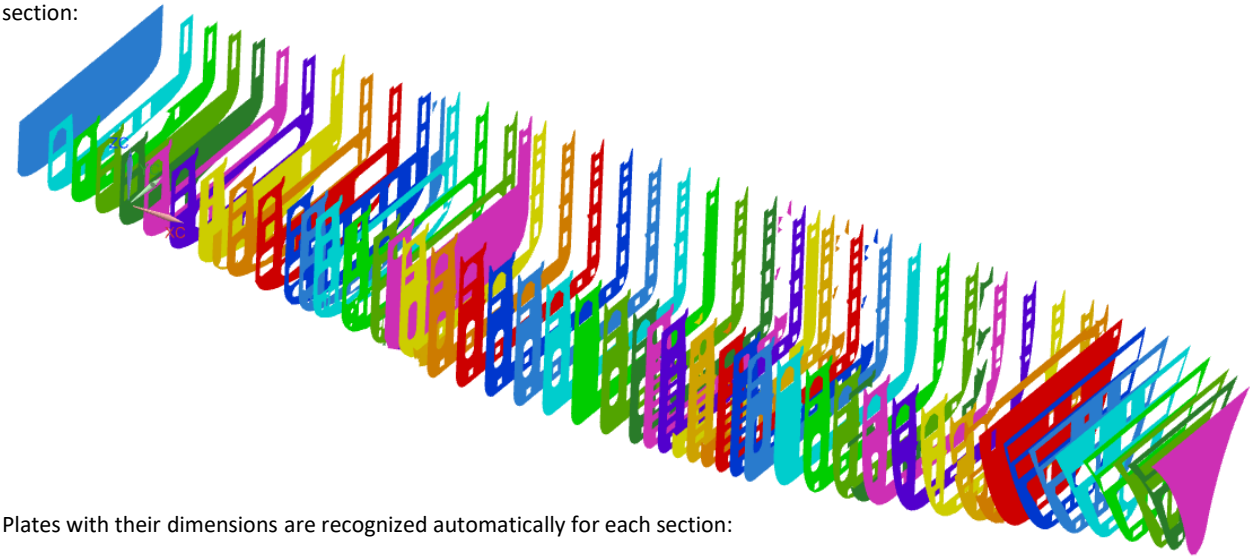


Plate buckling strength is an important aspect in offshore steel construction design. Each plate should be checked as it influences on the strength and stability of the whole construction. In SDC Verifier plates can be checked against buckling according to the ABS 2004/2014 and DNV RP-C201 2010 rules:

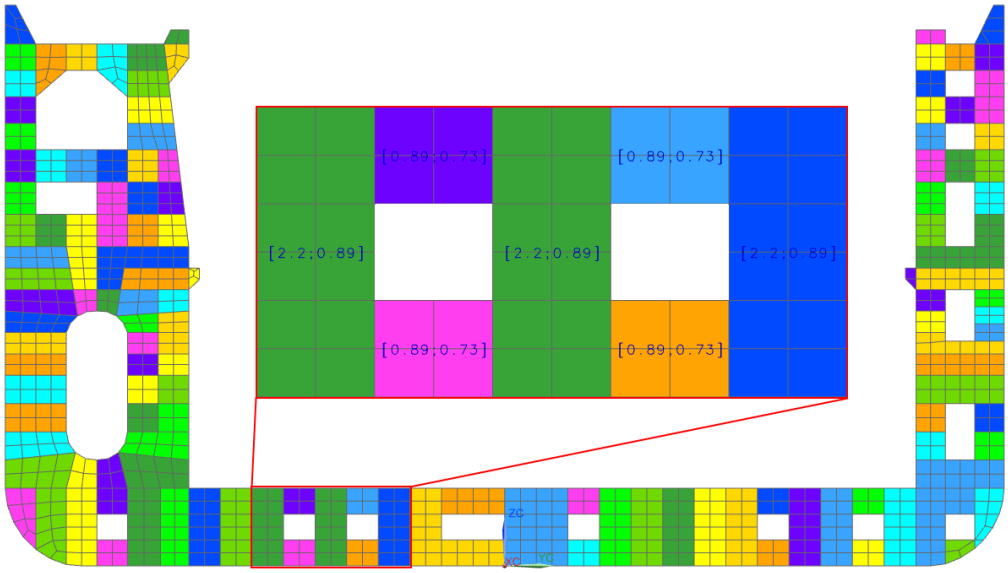
ABS 2004 & 2014

DNV 1995 & 2010

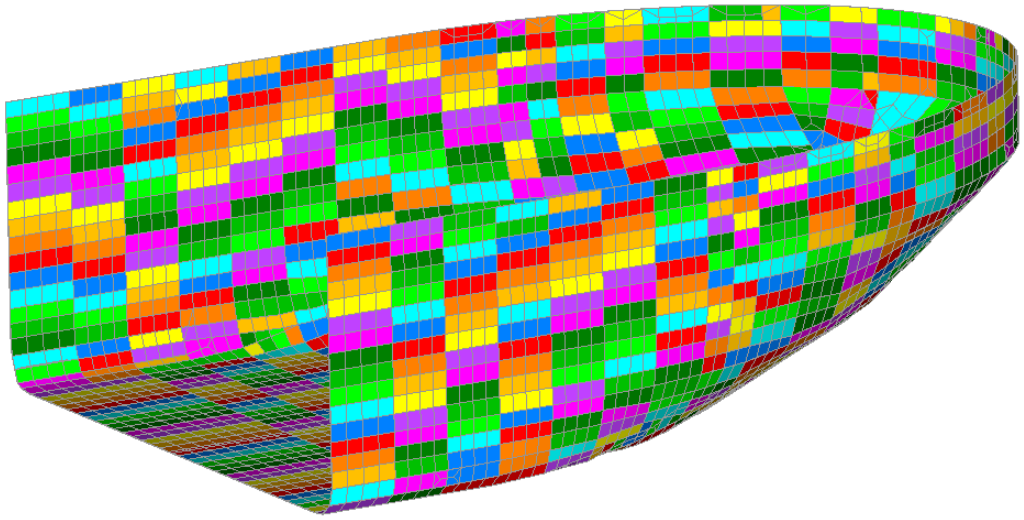
Plate dimensions are required to perform plate buckling check. Panel Finder recognizes X/Y/Z and custom (inclined and curved) section:



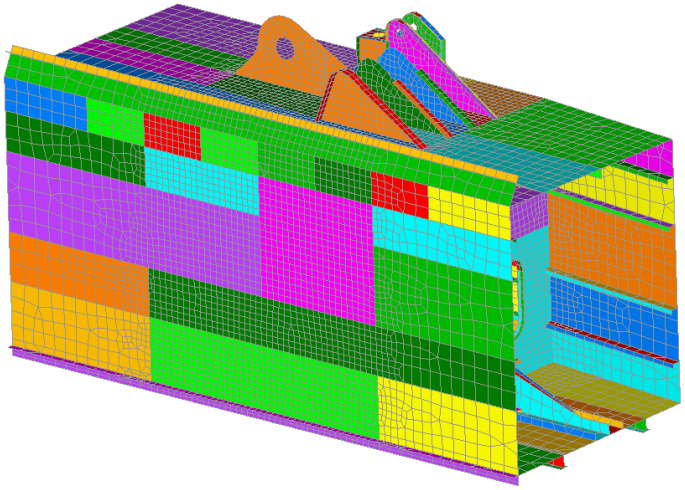
Plates with their dimensions are recognized automatically for each section:



Colored plots with labels (dimensions) make it easy to preview the results of the tool. The following plot present buckling plates on a part of the hull (curved section).



Recognition is based on mesh connectivity and can be performed on any structure build using plate (shell) elements:



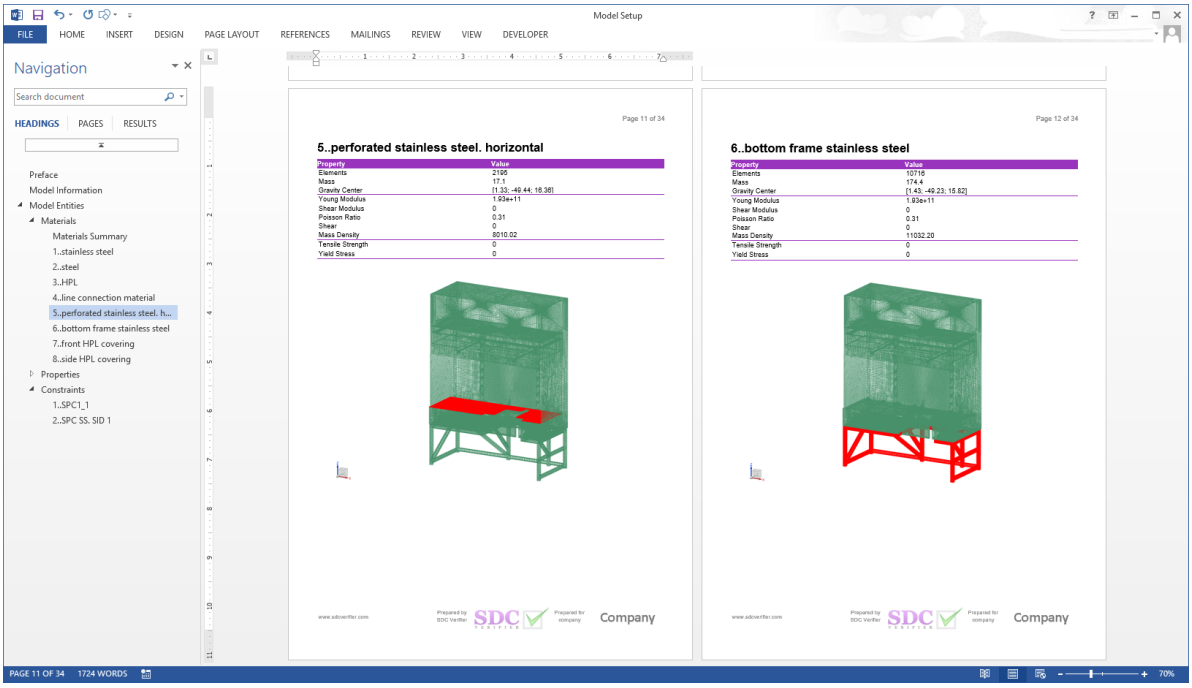
Results can be presented over sections (frames/longitudinals/decks) and results which are above the limit are highlighted with **red**:

Buckling(LS2, 5 Sections)

Standard	10..Plate Buckling DNV 2010	**Check**	1..Plate Buckling (Element Avg)
Load Set	2..Load Set 2	**Sections**	5
Search Type	Related To Last		

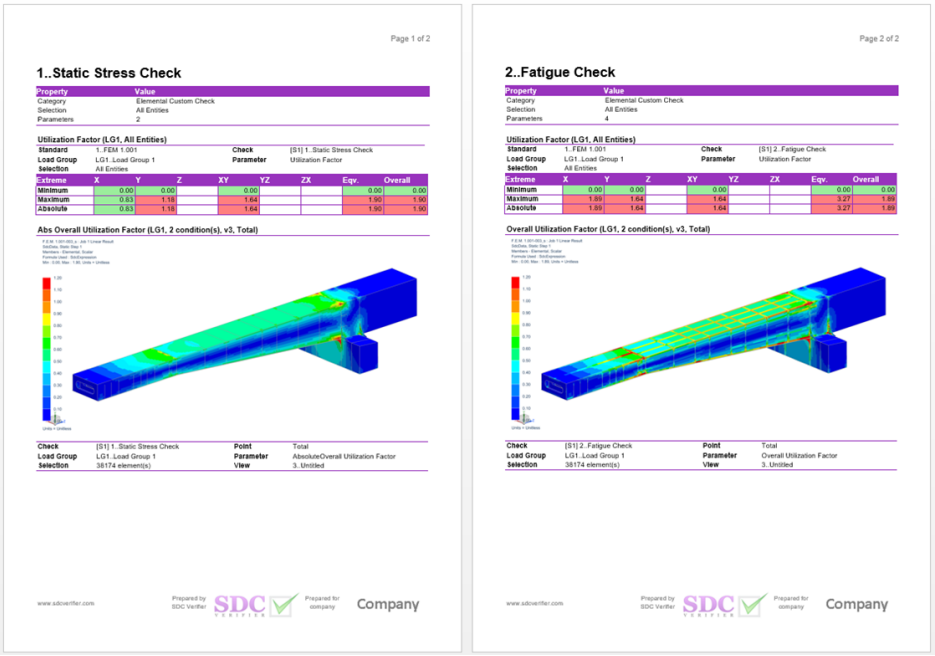
Section Title	Stress X in plate direction	Stress Y in plate direction	Stress XY in plate direction	Equivalent Stress	Buckling Factor Combined	Buckling Factor Overall
1..Section X 1 (X = 70) [MaxID=86]	-62.0e+6	-38.3e+6	-38.4e+6	85.8e+6	0.952	0.976
2..Section X 2 (X = 71.68) [MaxID=10]	-7.2e+6	-31.6e+6	-8.1e+6	31.9e+6	0.335	0.579
3..Section X 3 (X = 73.36) [MaxID=63]	-57.0e+6	-42.5e+6	-44.3e+6	92.3e+6	1.034	1.017
4..Section X 4 (X = 75.04) [MaxID=9]	-7.2e+6	-31.5e+6	-8.1e+6	31.9e+6	0.334	0.578
5..Section X 5 (X = 76.72) [MaxID=67]	-63.7e+6	-38.9e+6	-39.2e+6	87.8e+6	0.993	0.996
Max over Sections [3 / 63]	-57.0e+6	-42.5e+6	-44.3e+6	92.3e+6	1.034	1.017

Preparing a full calculation report is one of the most time-consuming parts of the project. An engineer has to make the same routine processes to create calculation report from project to project. SDC Verifier allows the process of report generation to be done automatically, reducing time expenses.
Description of materials and properties data (including mass overview). Elements related to material/property are highlighted:

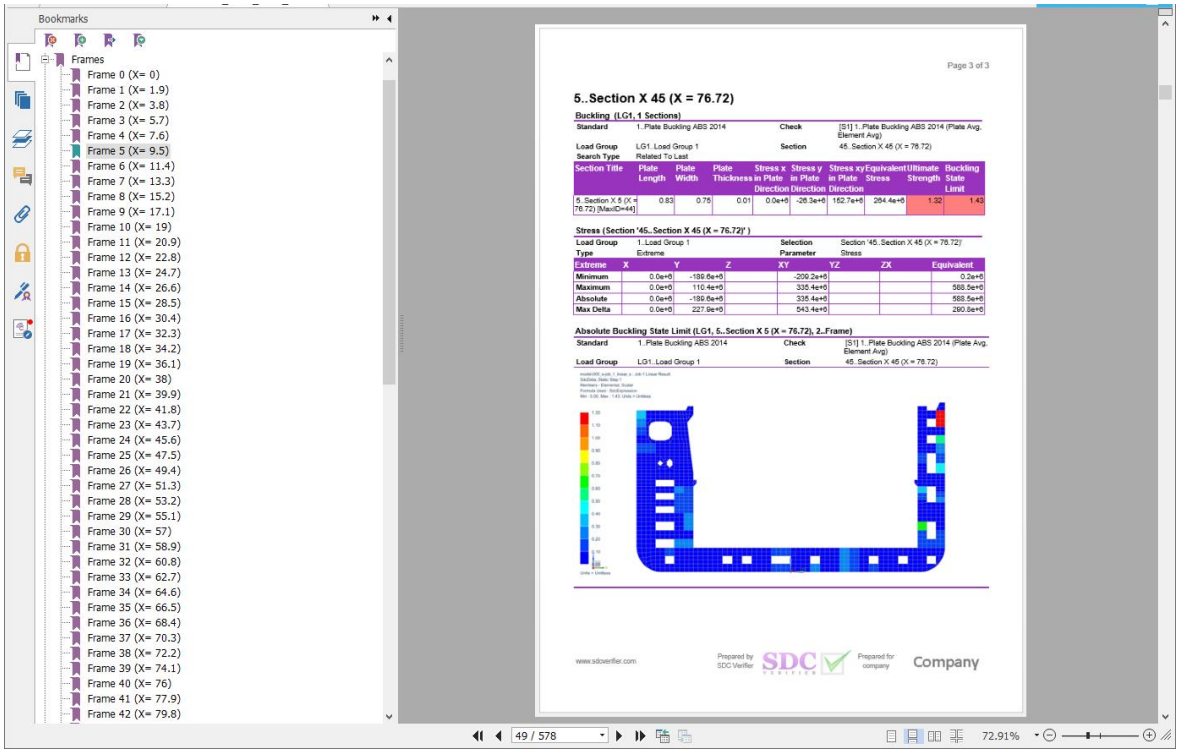


Description of applied loads and constrains, mass overview over materials/properties/groups:

Results contain plots and tables. It is possible to view detailed results for each entity, extreme results on selection and advanced tables to compare load results:

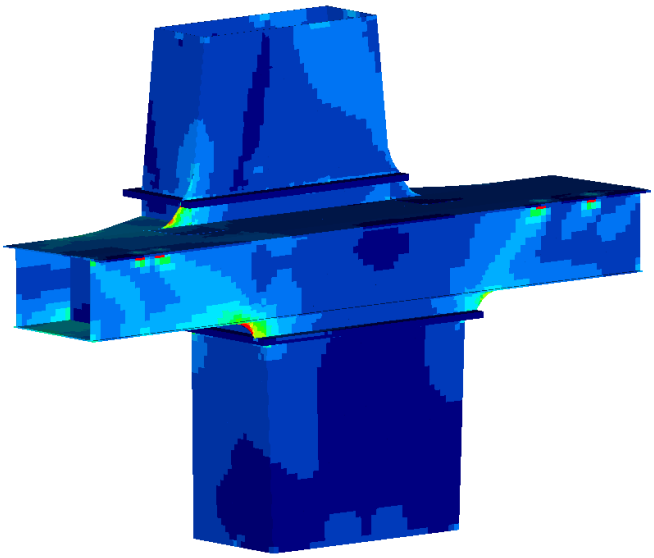


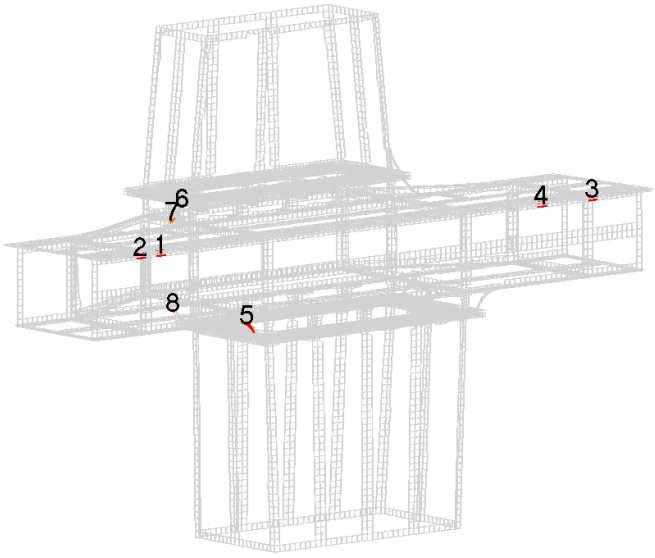
A complete setup of reports, with headings and bookmarks, enable quick navigation through the reports.



With help of Report designer, it is possible to completely control structure of the report and easily preview and modify it. A variety of tools helps to create quickly huge amount of plots and tables.

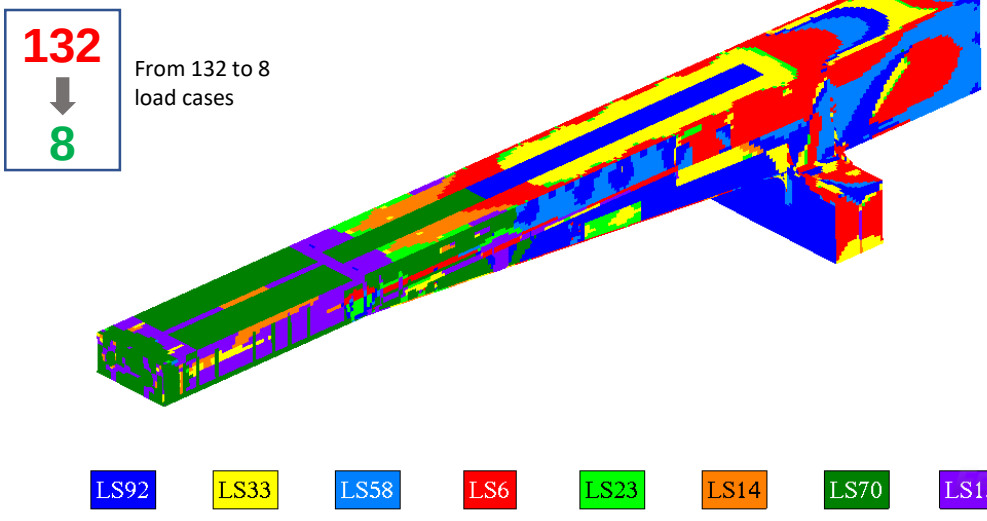
Peak Finder finds all peak zones based on output results and presents them using a special plot and a summary table. The peaks for any simple FEA results as stresses, strains or displacements can be found but also all available results from the SDC Verifier checks (Fatigue, Beam Bucking, etc.)



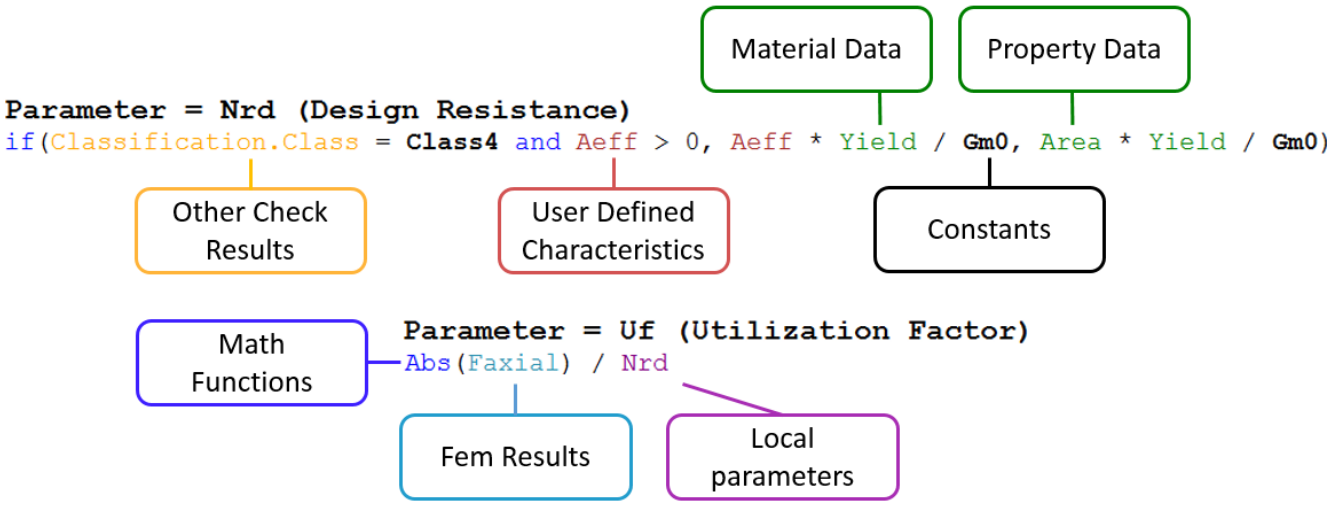


Zone	Value	Zone	Value
Zone 1 (Elements: 2)	1.45	Zone 5 (Elements: 15)	1.41
Zone 2 (Elements: 2)	1.44	Zone 6 (Elements: 1)	1.21
Zone 3 (Elements: 2)	1.43	Zone 7 (Elements: 3)	1.09
Zone 4 (Elements: 2)	1.42	Zone 8 (Elements: 1)	1.01

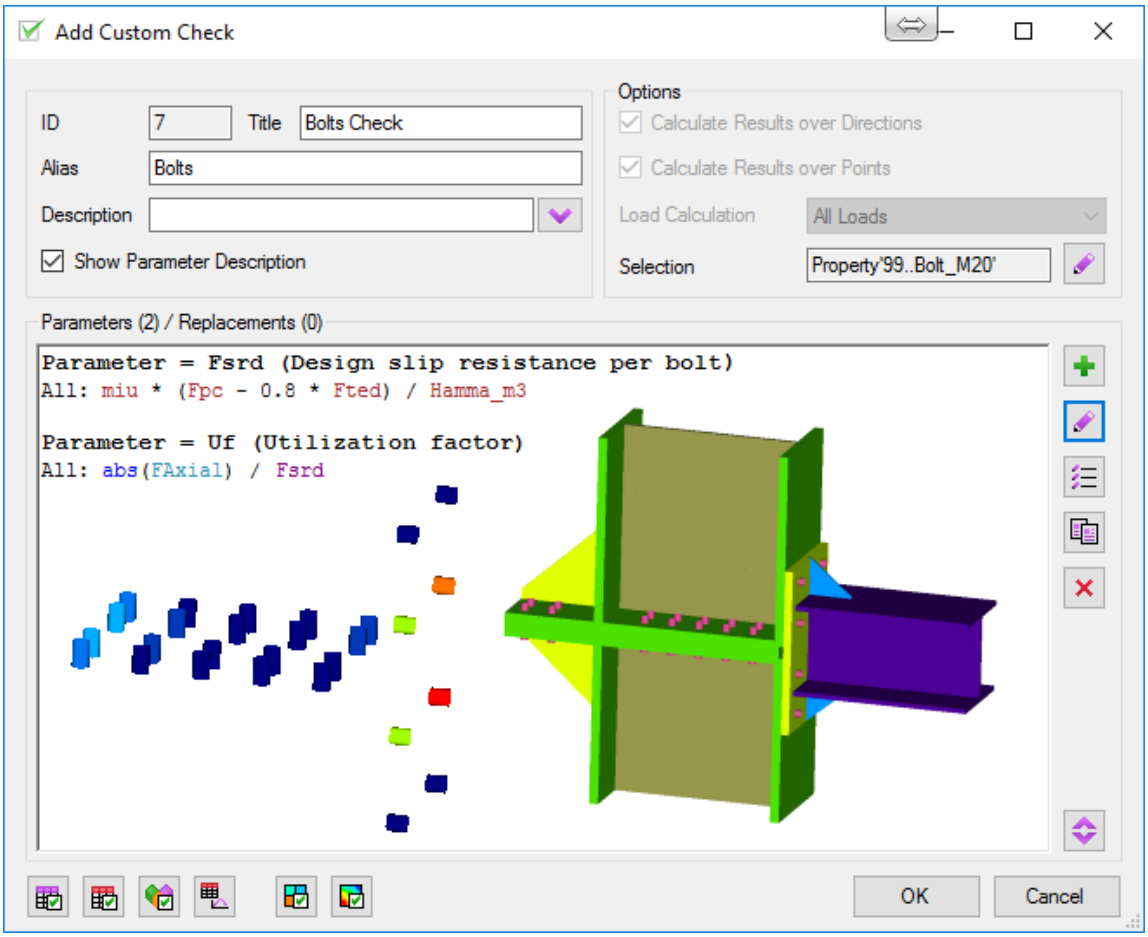
Governing loads tool extracts the critical loads out of a large group of load combinations. Instead of checking all the situations focus on important ones and reduce calculation time.



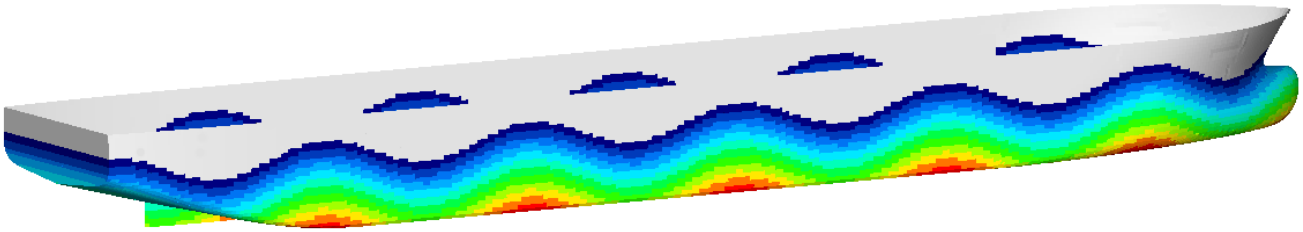
The checks in SDC Verifier are completely customizable. With the help of a formula editor user-defined formulas can be created based on results, model properties and recognized dimensions.



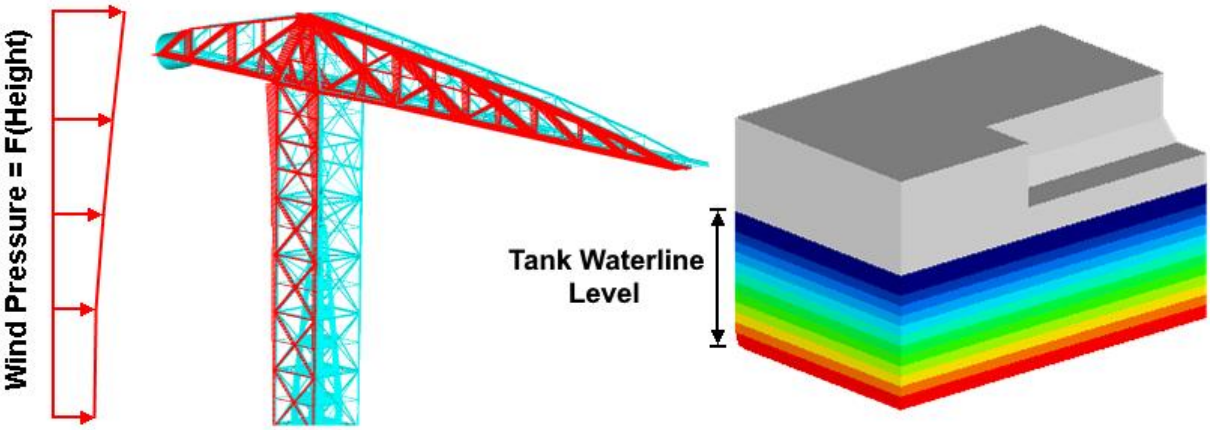
The following example performs verification of bolted connections. Axial Force of bolts is compared with bolt design resistance:



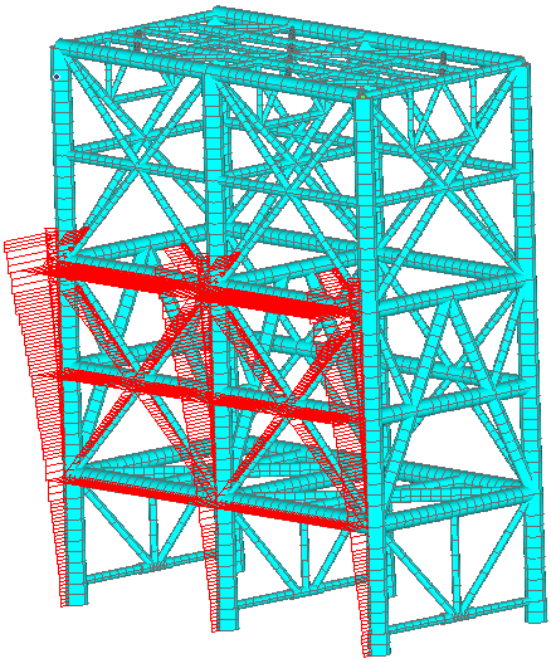
In SDC Verifier it is possible to apply complicated loads: buoyancy, tank ballast and wind.
Buoyancy – a water pressure acting on a construction (e.g. ship hull) including wave parameters.



Tank Ballast – fluid level based on a mass content transferred into a pressure level on a tank surface.
Wind – height dependent pressure applied to the model taking into account the element area exposed to the wind direction.



Wave and current loads – apply force and pressure based on wave parameters (height, length, crest, amplitude, etc.):



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