

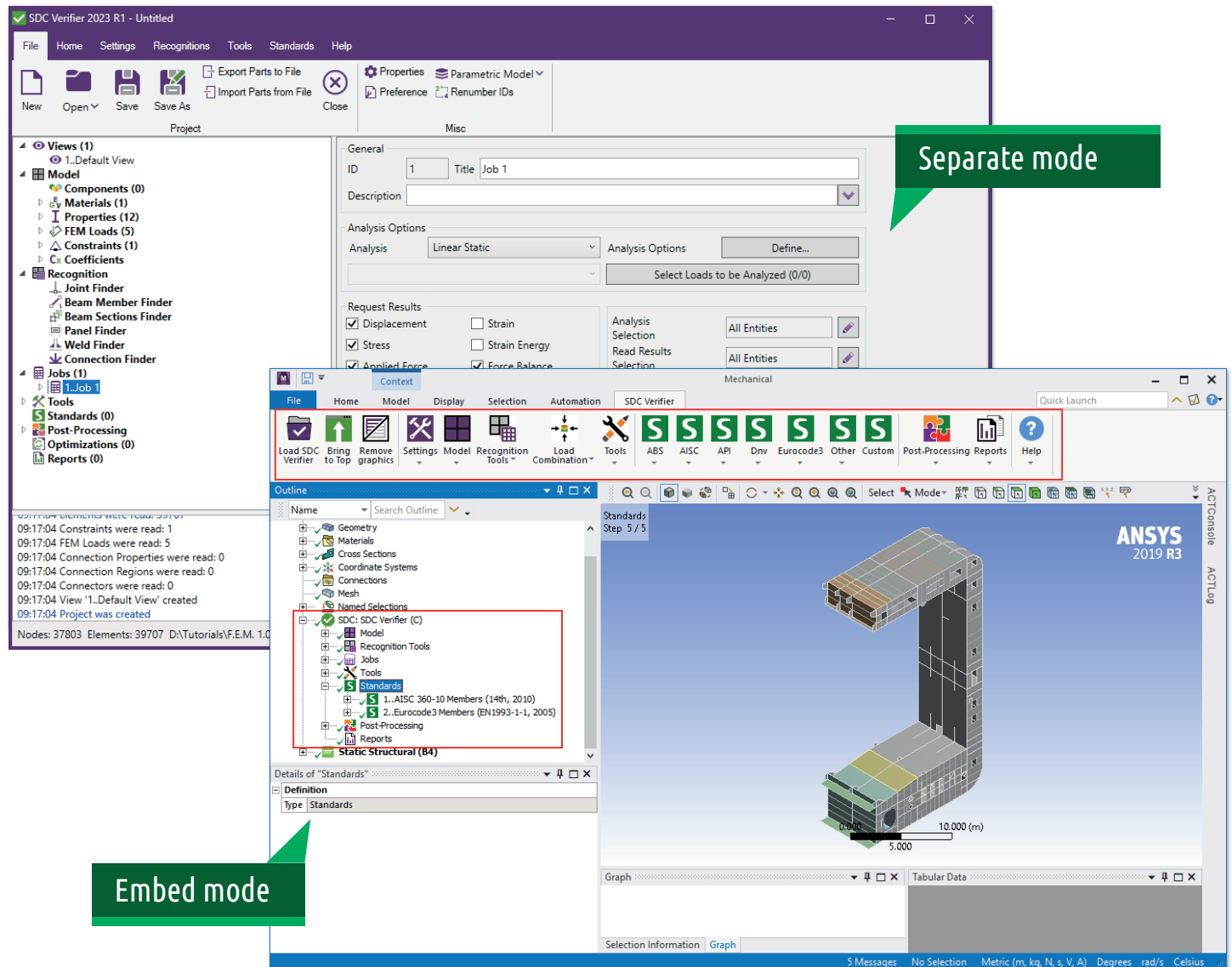


STRUCTURAL VERIFICATION ACCORDING TO STANDARDS



SDC VERIFIER FOR ANSYS

SDC Verifier is the powerful, integrated in Workbench, extension for **Ansys** which automates verification of structures in accordance with different industries design and safety standards.



TAILOR MADE FOR THE FOLLOWING INDUSTRIES



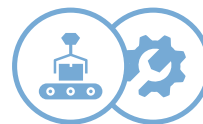
OFFSHORE AND
MARITIME



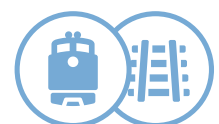
OIL AND GAS



HEAVY LIFTING



MACHINERY
EQUIPMENT



RAILWAY



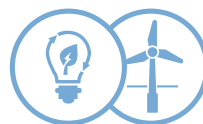
CIVIL
ENGINEERING



PIPES AND
PETROCHEMICAL



AEROSPACE



RENEWABLE
ENERGY



DEFENSE

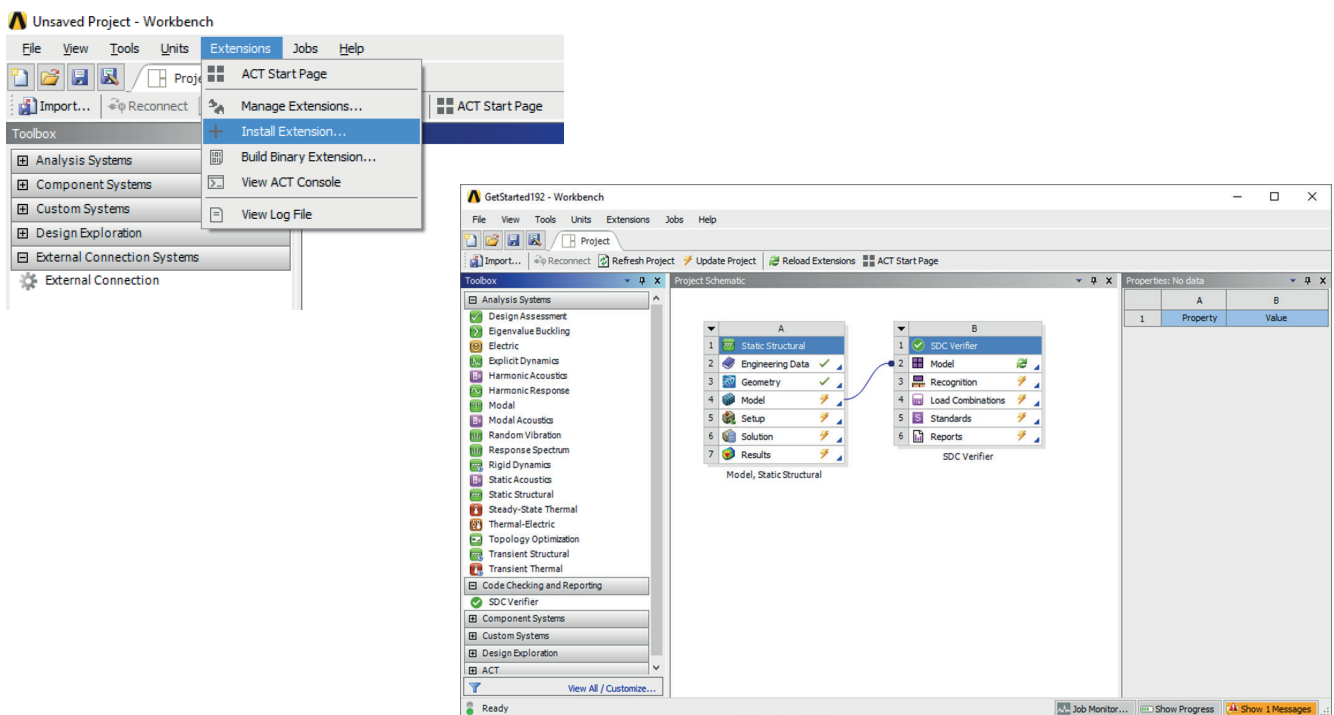
Ansys offers an advanced engineering analysis environment for simulation of complex engineering problems.

SDC Verifier together with Ansys 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 the report regeneration.

The optimization module allows the best design decision to be made for the structure by calculating different combinations of design inputs.

In addition SDC Verifier has an open API to help automate interaction with software.

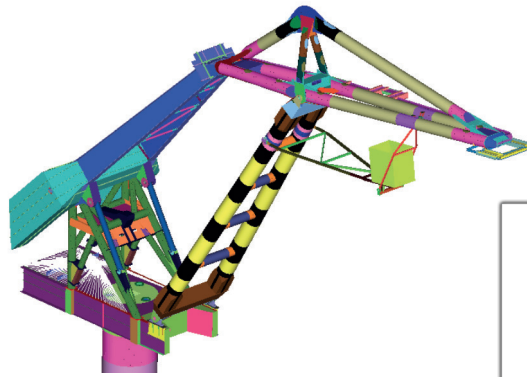


ASK FOR A TRIAL AT

sdcverifier.com

sales@sdcverifier.com
+31 2336 99 036

SDC VERIFIER WORKFLOW



FEA Simulation



Reports

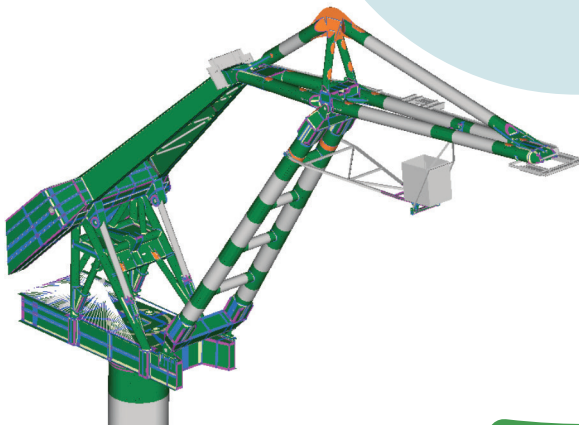
Edit Load Sets

	Safety Factor	IL1, IL11	IL2, IL12	IL3, IL13	IL4, IL14	IL5, IL15	IL6, IL16	IL7, IL17	IL8, IL18	IL9, IL19	IL10, IL20	IL11, IL21	IL12, IL22
LC1_Long_forestay_1	1.33	1.43				1.1	-1.1					-1.1	
LC1_Long_forestay_2	1.33	1.43				1.1	-1.1					-1.1	
LC1_Long_forestay_3	1.33	1.43				1.1	-1.1					-1.1	
LC1_Long_forestay_4	1.33	1.43				1.1	-1.1					-1.1	
LC1_Long_short_1	1.33	1.43				1.1	-1.1					-1.1	
LC1_Long_short_2	1.33	1.43				1.1	-1.1					-1.1	
LC1_Long_short_3	1.33	1.43				1.1	-1.1					-1.1	
LC1_Long_short_4	1.33	1.43				1.1	-1.1					-1.1	
LC1_Short_forestay_1	1.33		1.43		1.1		-1.1						-1.1
LC1_Short_forestay_2	1.33		1.43		1.1		-1.1						-1.1
LC1_Short_forestay_3	1.33		1.43		1.1		-1.1						-1.1
LC1_Short_forestay_4	1.33		1.43		1.1		-1.1						-1.1

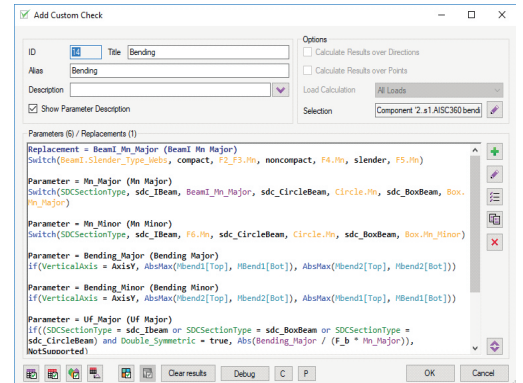
OK Cancel

Load Combinations

The complete structure verification procedure is stored so you can generate the updated report in one click in case of design changes



Recognition



Checks

IMPLEMENTED STANDARDS

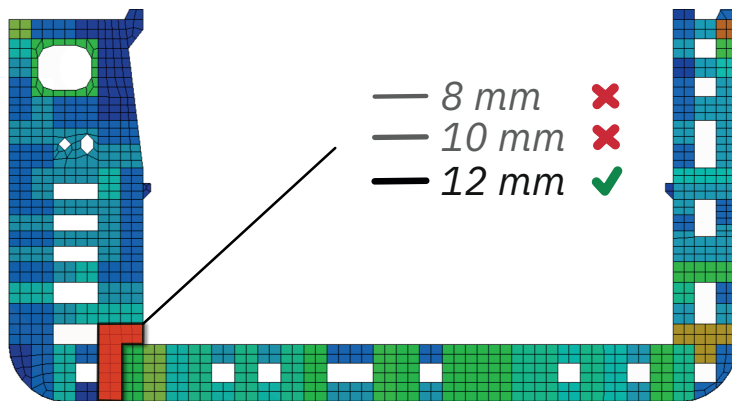
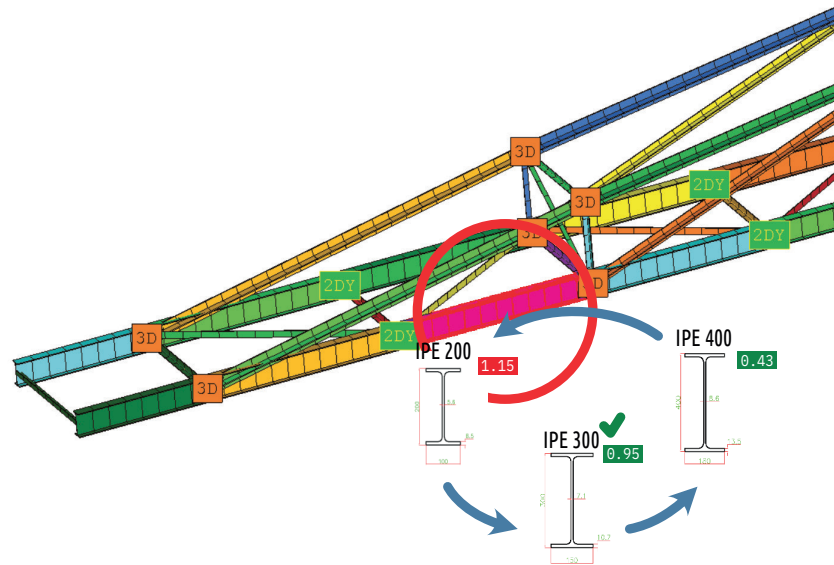


DESIGN OPTIMIZATION

SPECIFIC LOADS

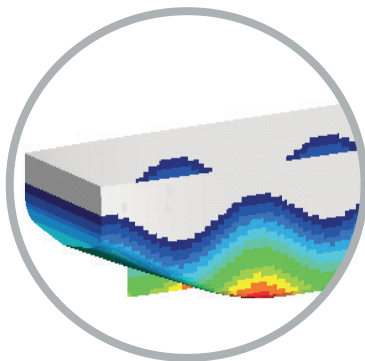


The **Optimization module** helps to take the best possible design decision acquired from code-checking results. Optimization can be based on Cross Section, Weld Type, Yield Stress, and Plate Thickness parameters.

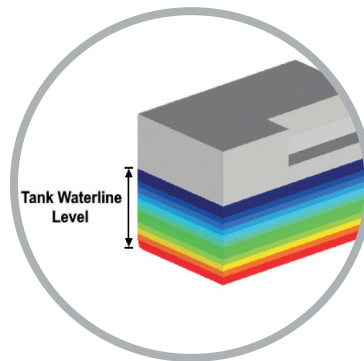


Optimization helps to automatically calculate various design input combinations and ensure cost-effectiveness by adjusting the existing model parts for specific terms of usage.

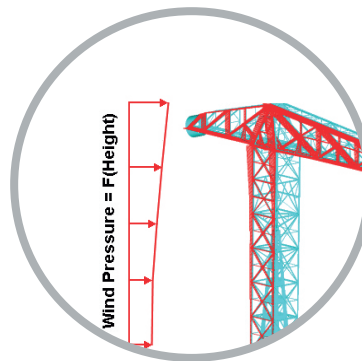
SDC Verifier automates the application of the specific loads:



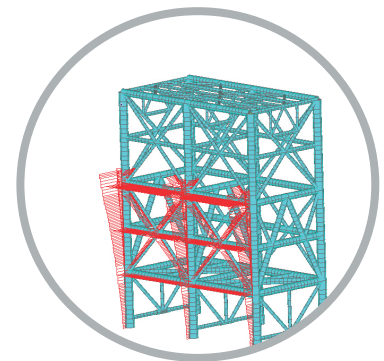
Buoyancy – a water pressure acting on a construction (e.g. ship hull), including wave parameters.



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.).



SDC Verifier implements the following standards for checking large (*offshore*) lattice structures:

AIJ (2017)

EN 13001

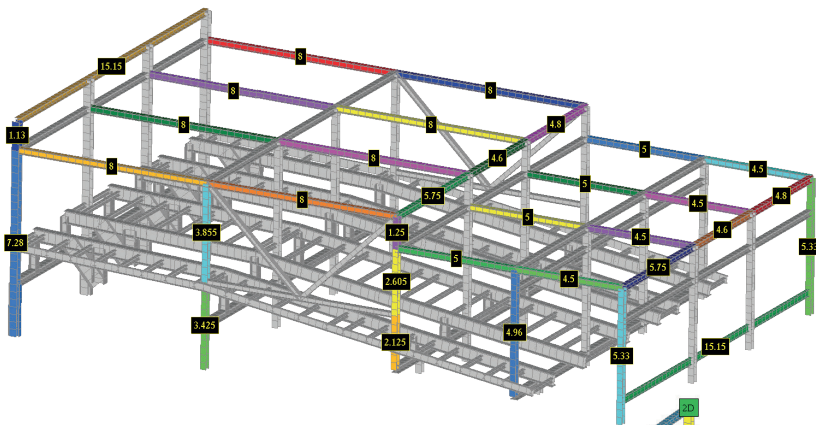
AISC/ANSI 360-10 and **AISC 360-22** (*Specification for Structural Steel Buildings*), **API RP 2A** (*Planning, Designing, and Constructing Fixed Offshore Platforms – Working Stress Design*), **Eurocode 3** (*Design of steel structures*), **ISO 19902 (2007, 2020)** (*Petroleum and natural gas industries – Fixed steel offshore structures*) and **Norsok N-004** (*Design of steel structures*), **EN 13001** (*Cranes General Design*, 2018)



AISC 89 & 2010
AISC 360-22

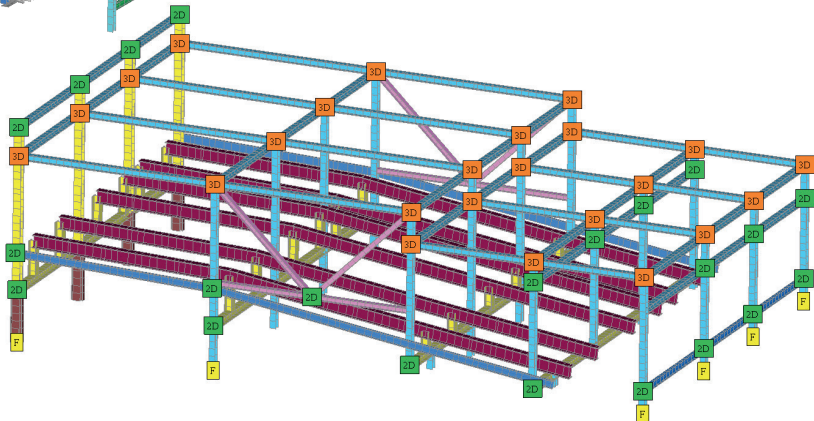


API RP 2A RP

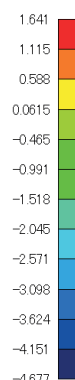
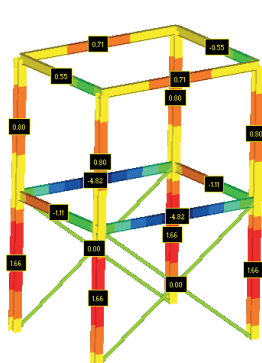
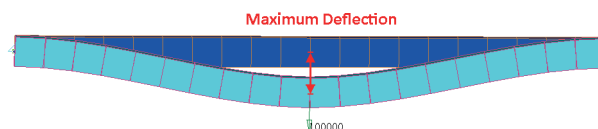


SDC Verifier calculates the **Buckling length** between the Joints, regardless of the model mesh.

Beam Member Finder tool
automatically detects beam
members (*buckling*) lengths for
3 directions (*Y, Z and torsional*).

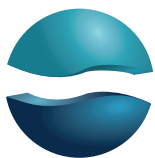


The deflection of members is one of the checks that should be performed for serviceability limit state design. With the help of the **Beam Member Finder** tool SDC Verifier automatically detects beam member lengths:



SDC Verifier contains all the necessary tools to quickly perform the **deflection check**.

The automatic beam member recognition, result transformation, and the usage of the envelope results of a load group reduce the calculation and post-processing time significantly.



Norsok N004



AS 3990 (1993)

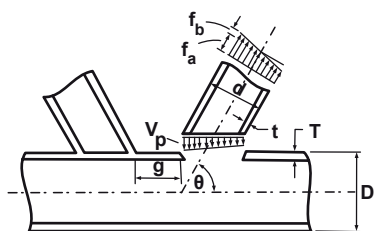
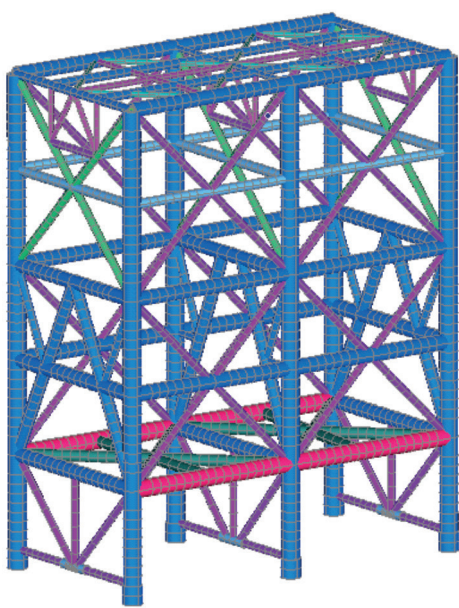


ISO 19902
(2007, 2020)

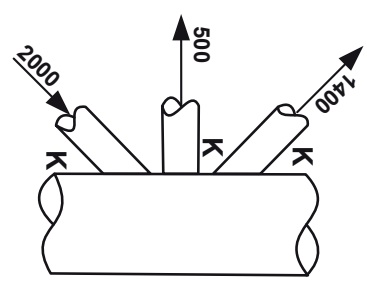
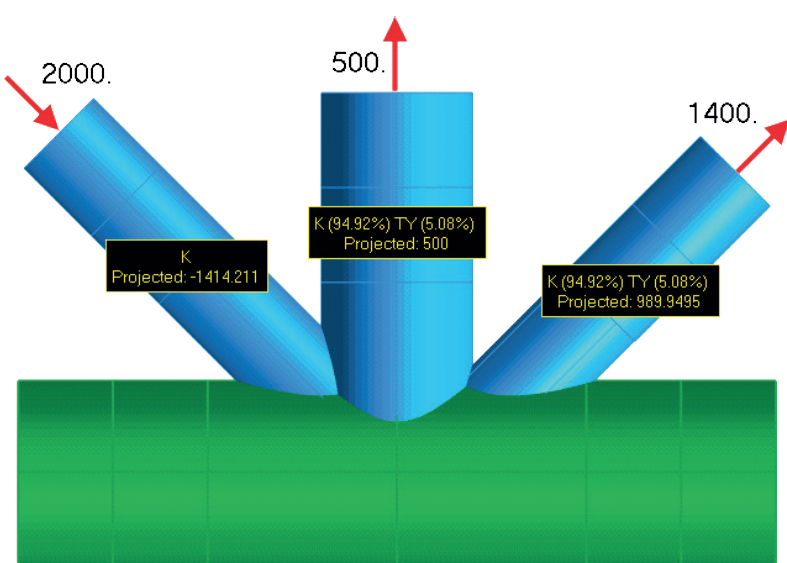
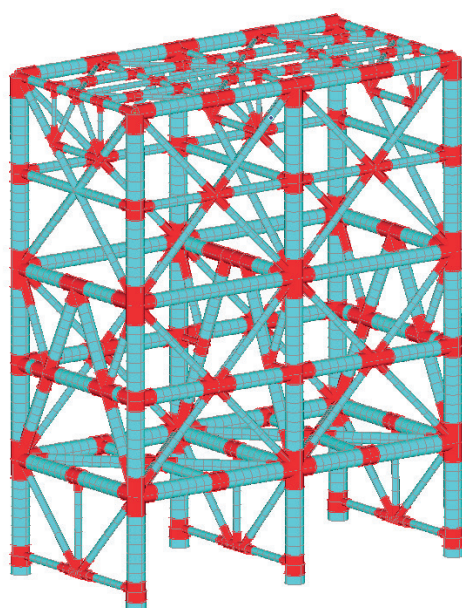


Eurocode 3

Joint Finder tool is used to verify tubular joints according to **API RP 2A**, **Eurocode 3**, **ISO 19902 (2007, 2020)**, and **Norsok N-004** standards.



SDC Verifier automatically calculates Brace classification (depending on the load pattern) for each load situation, 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 (8.08%)
	#3 (ElemID = 19)	K (94.92%) TY (8.08%)

AUTOMATIC DETECTION OF SECTIONS, PANELS, PLATE FIELDS, STIFFENERS, AND GIRDERS

Plate buckling strength is an important aspect of offshore steel construction design. Each plate should be checked as it influences the strength and stability of the whole construction. In SDC Verifier plates can be checked against buckling according to the **ABS 2004/2014**, **DNV RP-C201 2010** and **Eurocode 3** rules:



DNV 1995 & 2010

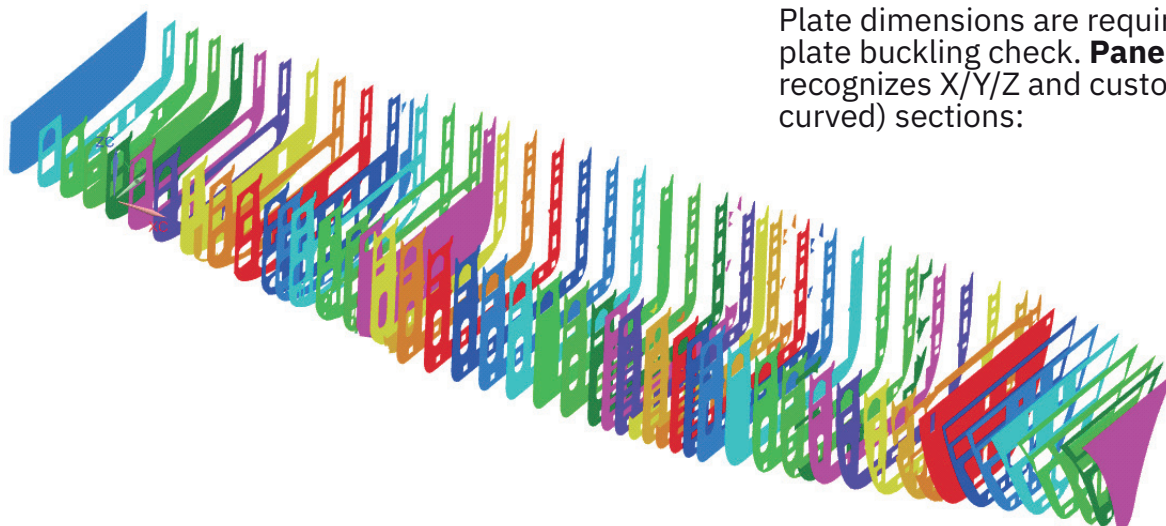


Eurocode 3

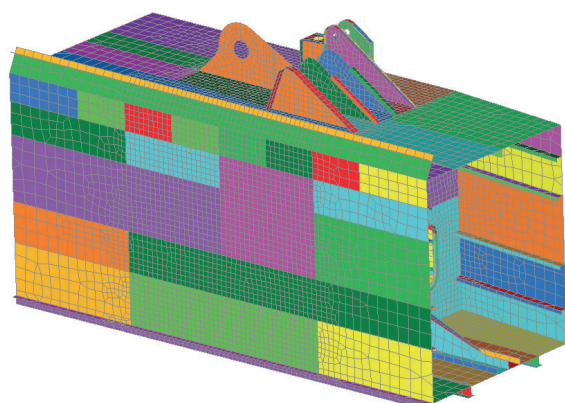


ABS 2004 & 2014

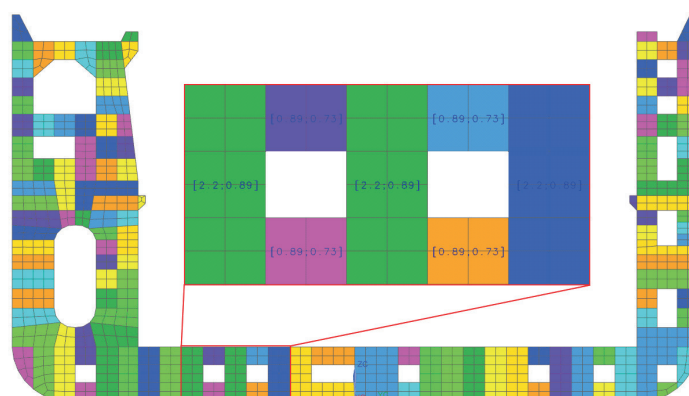
Plate dimensions are required to perform a plate buckling check. **Panel Finder** recognizes X/Y/Z and custom (inclined and curved) sections:



The recognition is based on the mesh connectivity and can be performed on any structure using plate (*shell*) elements:



Plates with their dimensions are recognized automatically for each section:



The results can be presented over sections (frames/longitudinals/decks). Those above the limit are highlighted in red:

Buckling(LS2, 5 Sections)

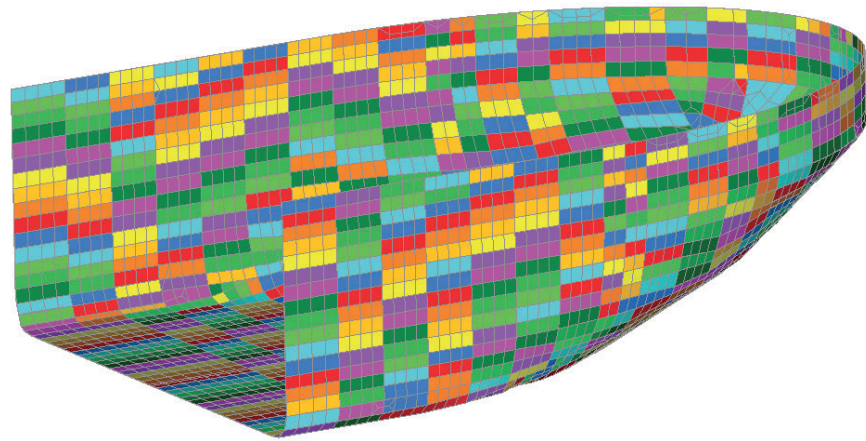
Standard 10..Plate Buckling DNV 2010
Load Set 2..Load Set 2
Search Type Related To Last

Check Sections 1..Plate Buckling (Element Avg)
 5

Section Title	Stress X in plate direction	Stress Y in plate direction	Stress XY in plate direction	Equivalen t 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

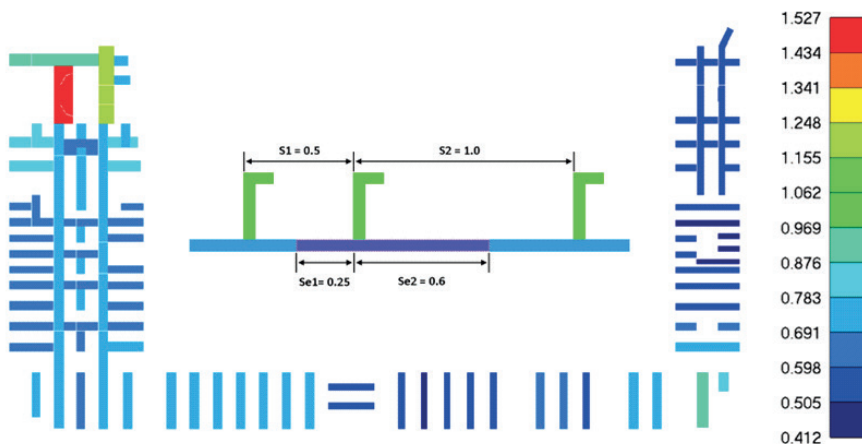
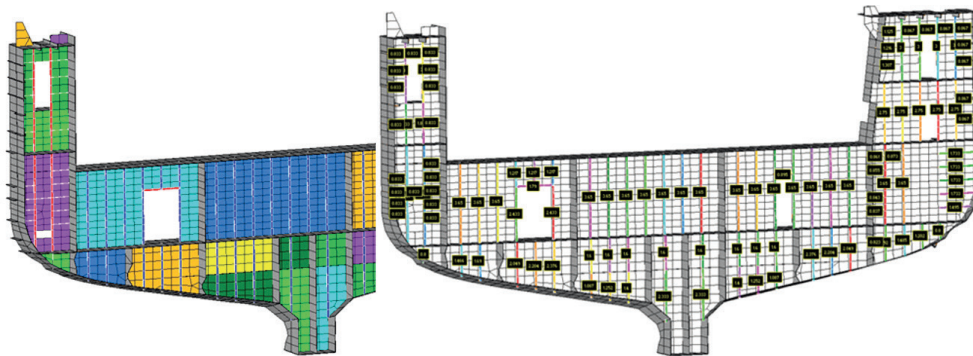
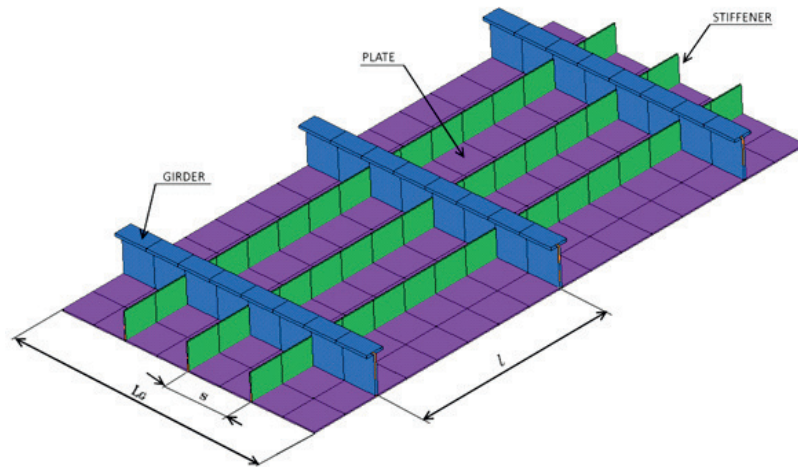
PLATE BUCKLING AND STIFFENER BUCKLING CHECKS

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



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

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



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

AUTOMATIC WELDS RECOGNITION. FATIGUE CHECKS AND WELD STRENGTH

Fatigue is a progressive structural damage of materials under the cyclic loading. SDC Verifier implements the following standards (based on the *S-N curves*): **Eurocode 3** (*Design of steel structures*), **F.E.M 1.001** (*Rules for the Design of Hoisting Appliances*), **DIN 15018** (*Cranes. Steel structures. Verification and analyses*), **FKM** (*Analytical strength assessment* (5th, 6th revised edition, 2003)), **EN 13001** (*Cranes General Design*, 2018).



FKM (5th and 6th edition)



DIN 15018



EN 13001



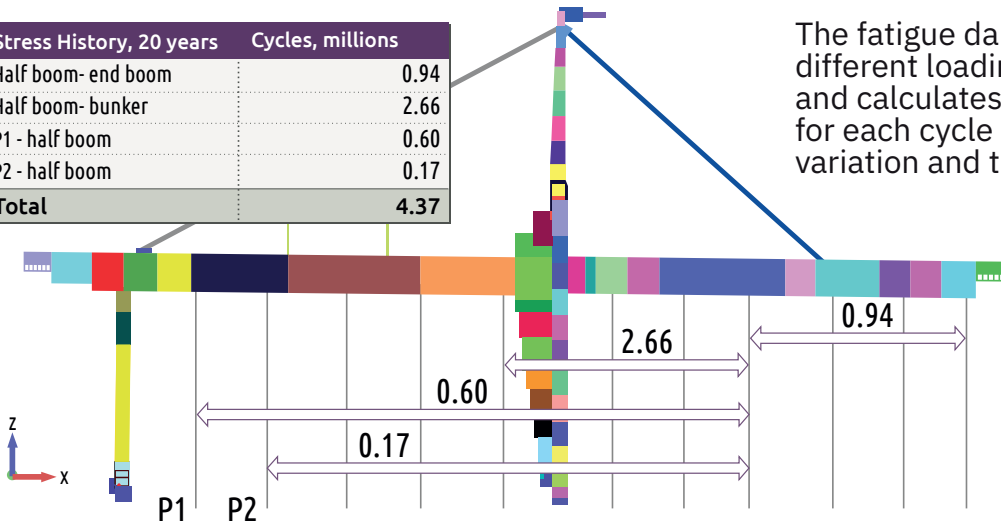
Eurocode 3



F.E.M 1.001

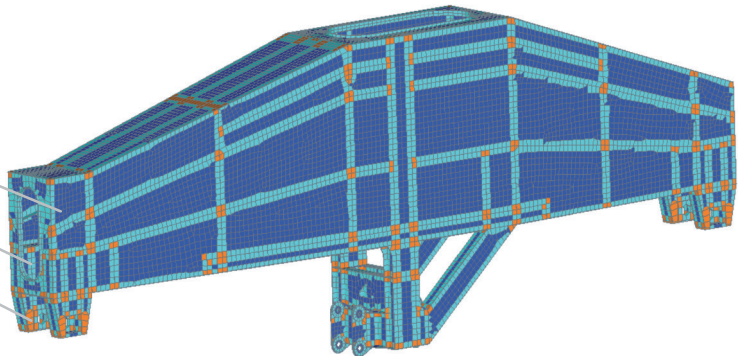
Stress History, 20 years	Cycles, millions
Half boom- end boom	0.94
Half boom- bunker	2.66
P1 - half boom	0.60
P2 - half boom	0.17
Total	4.37

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.



SDC Verifier tool **Weld Finder** detects automatically:

- non-welds
- welds
- crossing welds



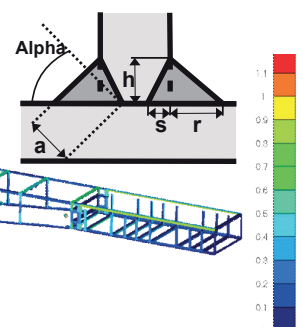
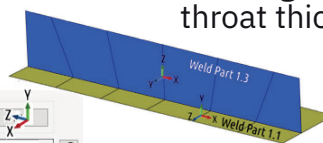
SDC Verifier performs a weld strength check according to **DNV-OS-C101/C201, Eurocode 3**.

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	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
Weld Part 2.2 [-29.6; 12.27; 2.99]	No	Rotation [-180; 90; 0]		5.53	-2.13	-0.55	0.05	0.12	0.02
Weld Part 2.3 [-29.6; 12.27; 2.99]	Yes	Rotation [-90; 0; 90]		-306.81	1.25	-15.16	0.01	-7.64	0.03
Weld Part 3.1 [-29.6; 12.27; 3.24]	No	Rotation [-180; -90; 0]		472.49	-2.61	-21.31	0.18	9.26	0.36
Weld Part 3.2 [-29.6; 12.27; 3.24]	No	Rotation [-180; 90; 0]		11.73	-2.25	-0.03	0.05	0.20	-0.04
Weld Part 3.3 [-29.6; 12.27; 3.24]	Yes	Rotation [-90; 0; 90]		-531.17	5.68	-33.08	-0.20	-13.46	-0.15

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





DVS 1608 (Design and strength assessment of welded structures from aluminum alloys in railway applications) – Aluminium Fatigue Check.

DVS 1608 (2010), DVS 1612 (2014)

DVS 1612 (Design and endurance strength analysis of steel welded joints in rail-vehicle construction) – Steel Fatigue Check and Static Stress Check.

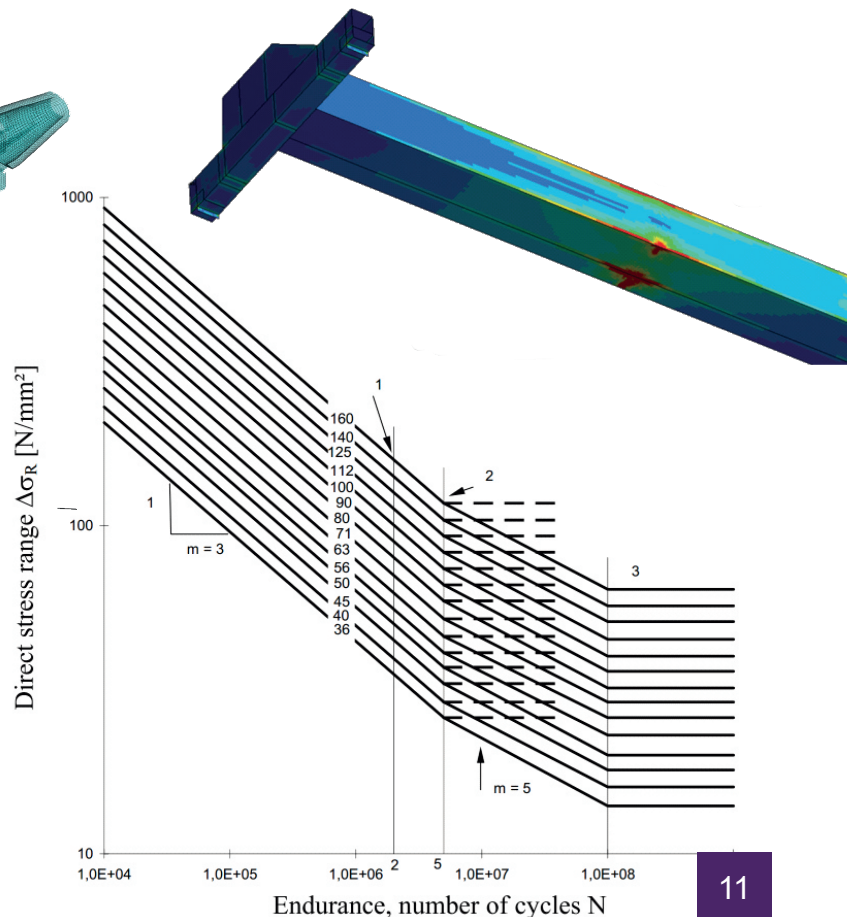
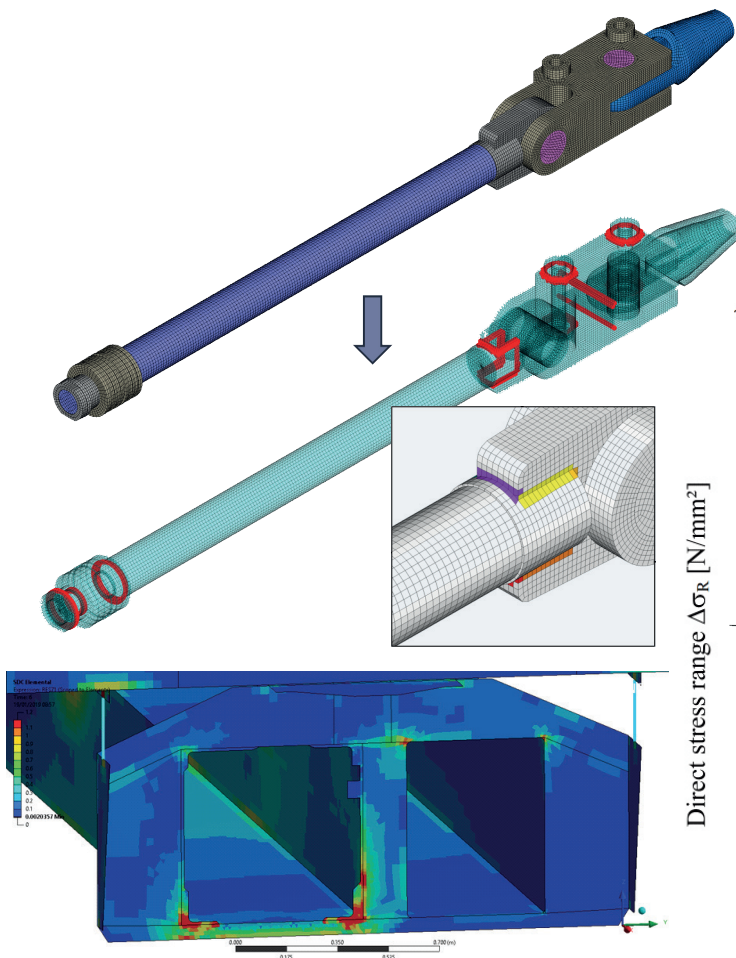
The notch group classification or fatigue strength of the welds depends on the quality and the stress direction, along the weld (X), perpendicular to the weld (Y) and the shear (XY). Stresses are converted into weld direction automatically by the weld finder.

☒ Edit Classification

ID: 1 Title: FAT Class
 Alias: FAT
 Description:

No.	Selection	Classification
1	Full Model	160
2	All Entities	100 (XY, YZ, ZX)
3	All welds	100 (X)
4	All welds	80 (Y)
5	All welds intersections	80 (X, Y, XY)

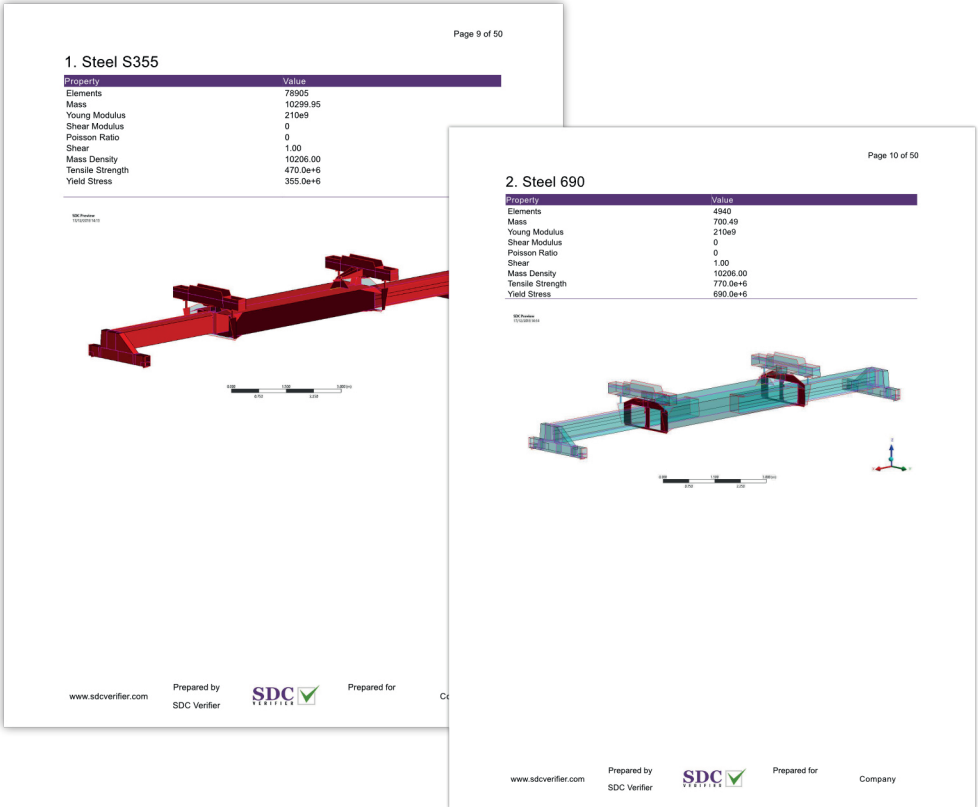
Detailed Category	Constructional detail
100	
80	
80	



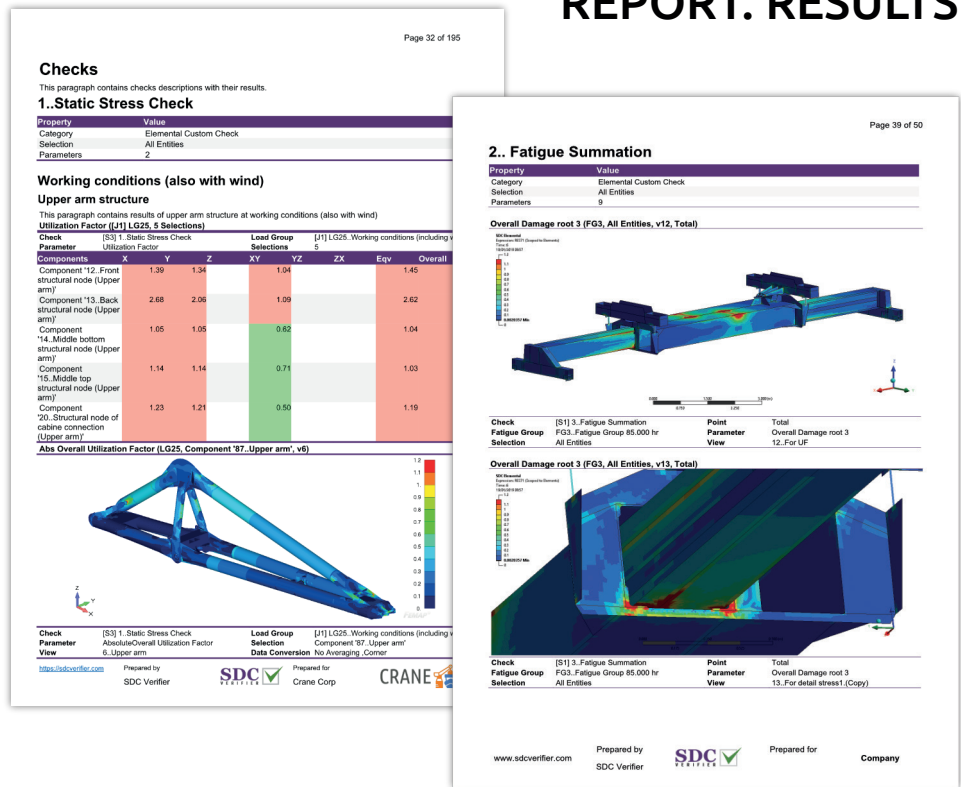
REPORT. MODEL SETUP

Preparing a full calculation report is one of the most time-consuming parts of the project. From project to project, an engineer repeats the same routine to create a calculation report. With SDC Verifier, the process of report generation is done automatically, reducing time expenses.

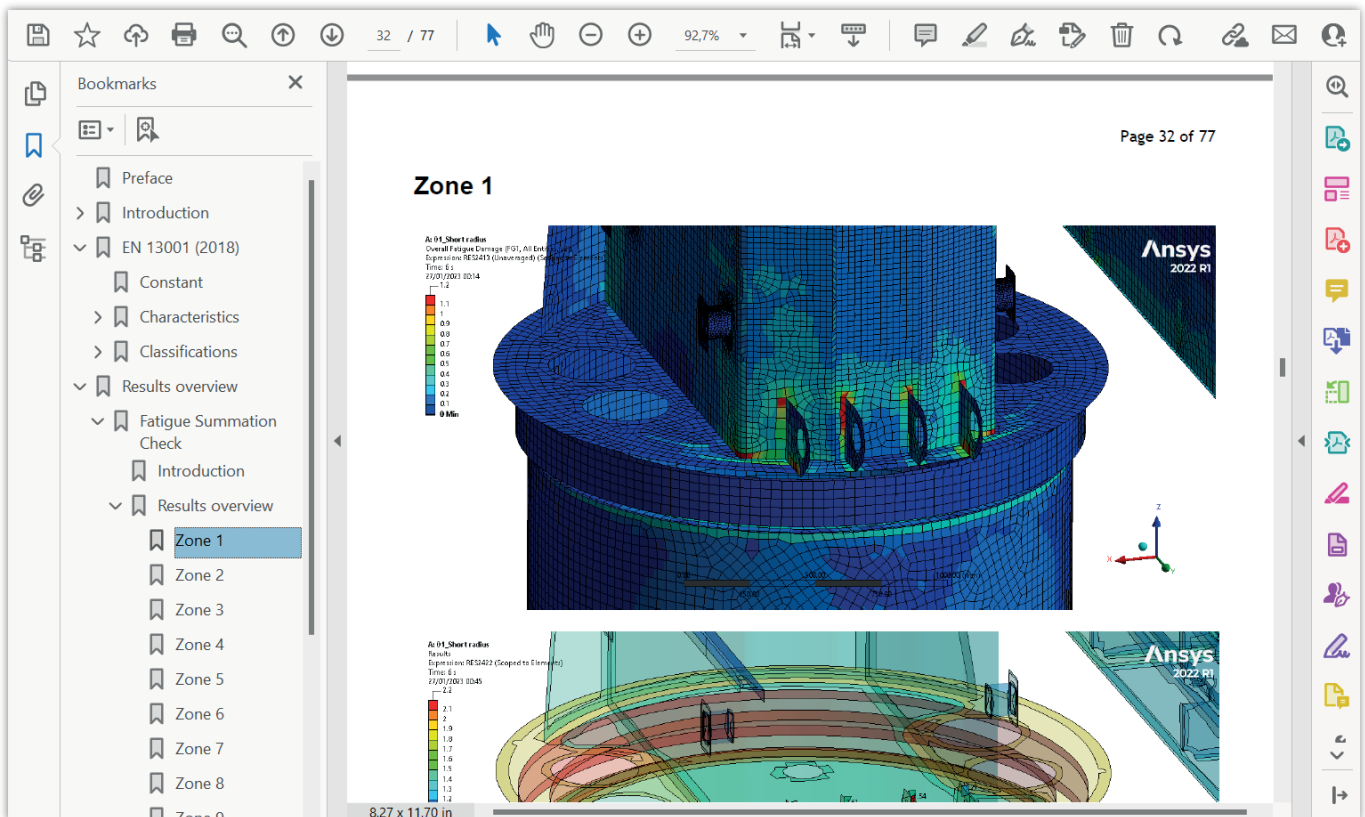
Materials and properties data (including mass overview) are described. Elements related to material/property are highlighted:



Results contain plots and tables. Detailed results for each entity, extreme results on selection, and advanced tables to compare load results are shown:



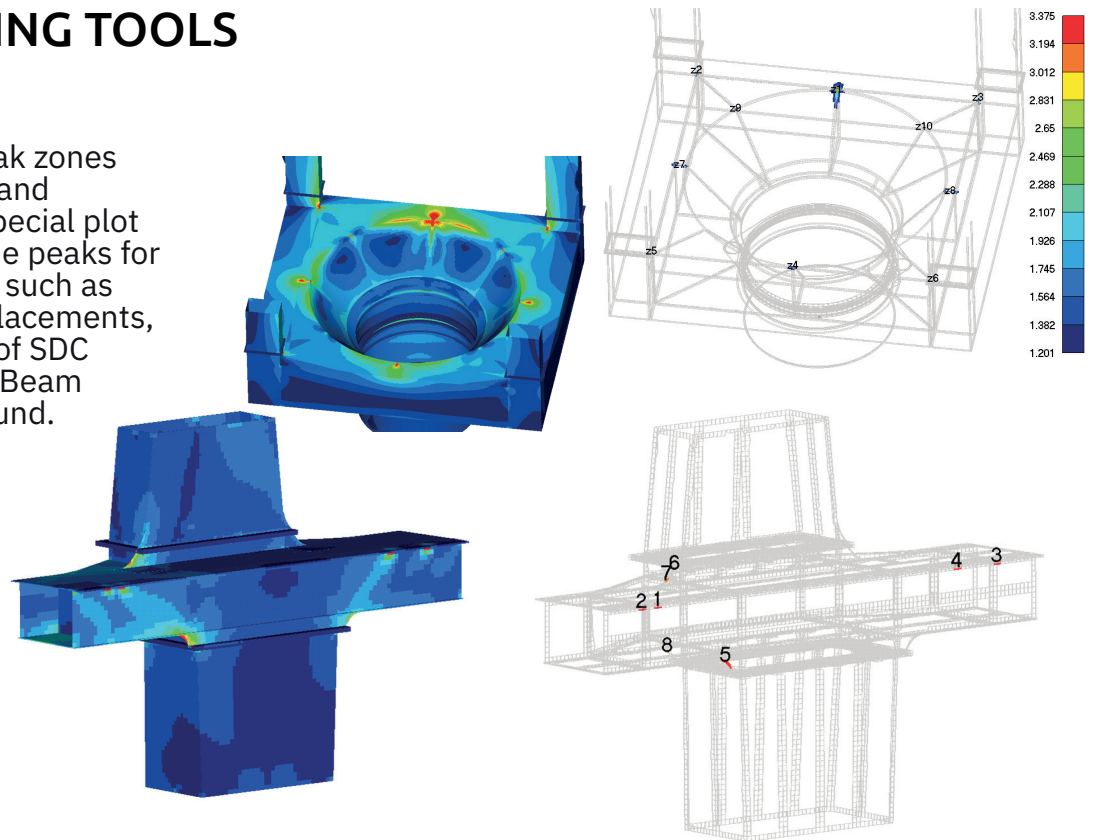
A complete setup with headings and bookmarks enables a quick navigation through the reports.



With Report Designer, you can control the report's structure and easily preview and modify it. A variety of tools helps to create a huge amount of plots and tables quickly.

POST-PROCESSING TOOLS

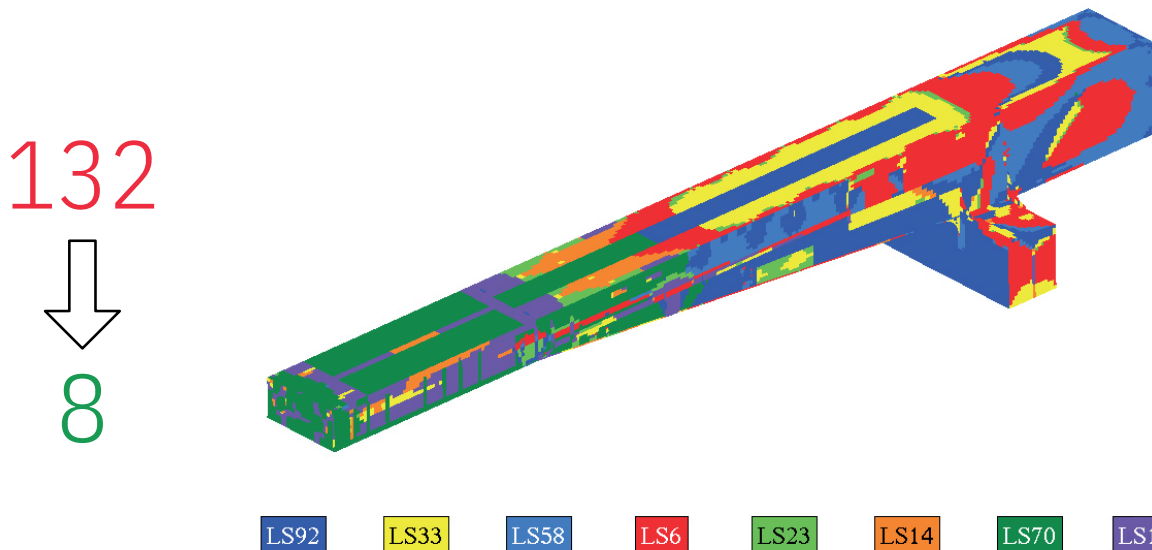
Peak Finder finds all peak zones based on output results and presents them using a special plot and a summary table. The peaks for both simple FEA results, such as stresses, strains, or displacements, and all available results of SDC Verifier checks (Fatigue, Beam Buckling, etc.) can be found.



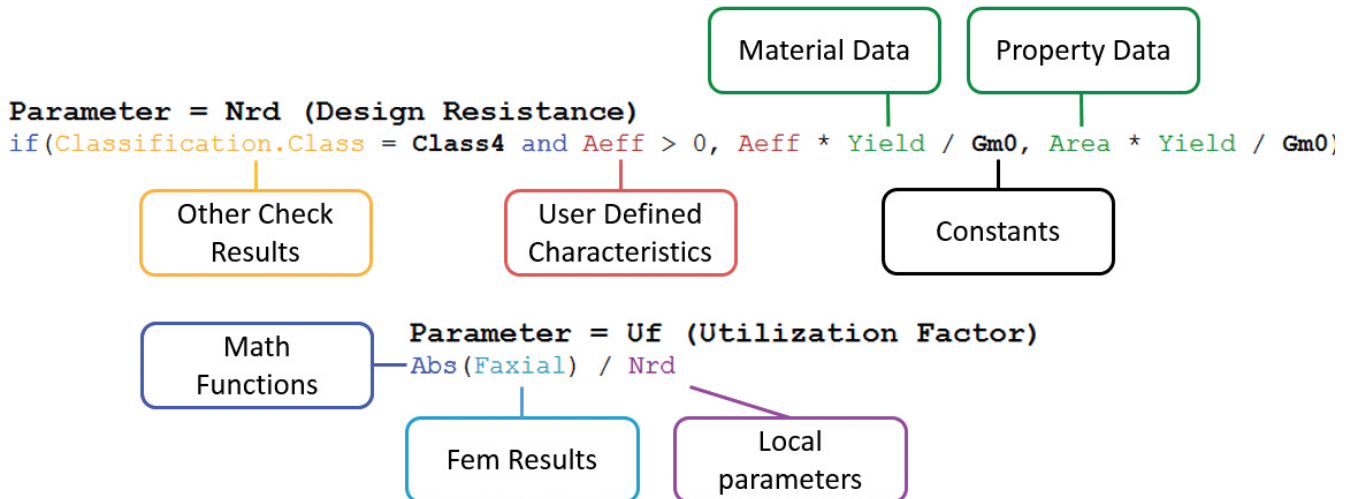
Zone	Value	Zone	Value
Zone 1 (Elements: 2)	1.45	Zone 5 (Elements: 15)	1.41
Zone 2 (Elements: 2)	1.44	Zone 6 (Elements: 1)	1.21
Zone 3 (Elements: 2)	1.43	Zone 7 (Elements: 3)	1.09
Zone 4 (Elements: 2)	1.42	Zone 8 (Elements: 1)	1.01

Governing loads tool extracts the critical loads out of a large group of load combinations. Save time focusing on important situations instead of checking each and every.

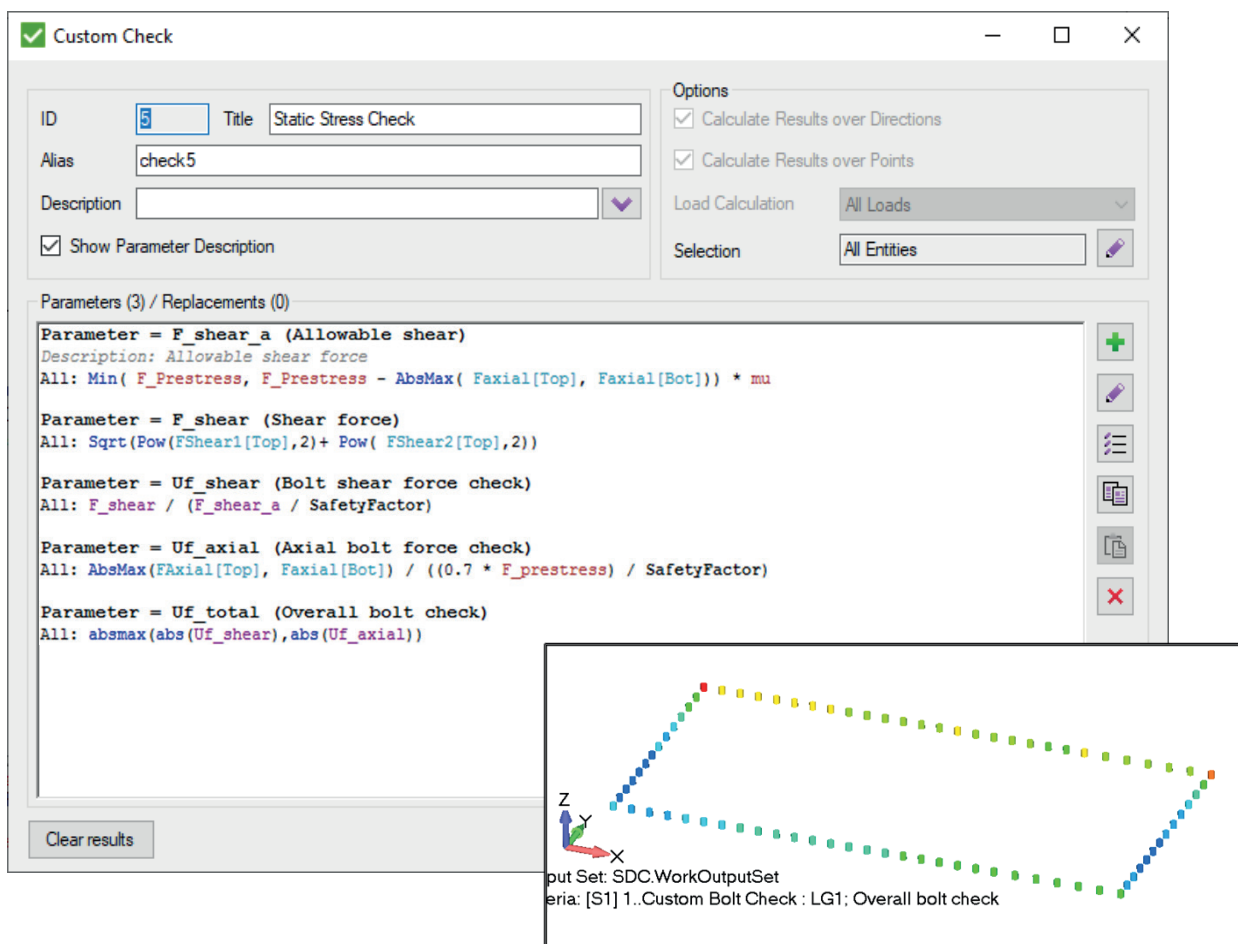
Only 8 load cases are defined as critical for this model and selected criteria, which will dramatically speed up the further verification process.



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



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



EXTENSIBLE MODULES

Acquire only some modules if you need specific features of the software



**SDC Reporting
and SPDM**



Weld Check



Fatigue



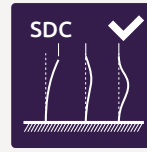
Bolt Check



**Plate & Stiffener
Buckling**



**Beam Member
and Joint Checks**



**Beam Member
Check**



**Eurocode 3
Beam Member**



FKM App



**AISC Beam
Member**

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