Sesam Tutorial

Plate Code Check in GeniE
by DNV Rule

DNV – Digital Solutions

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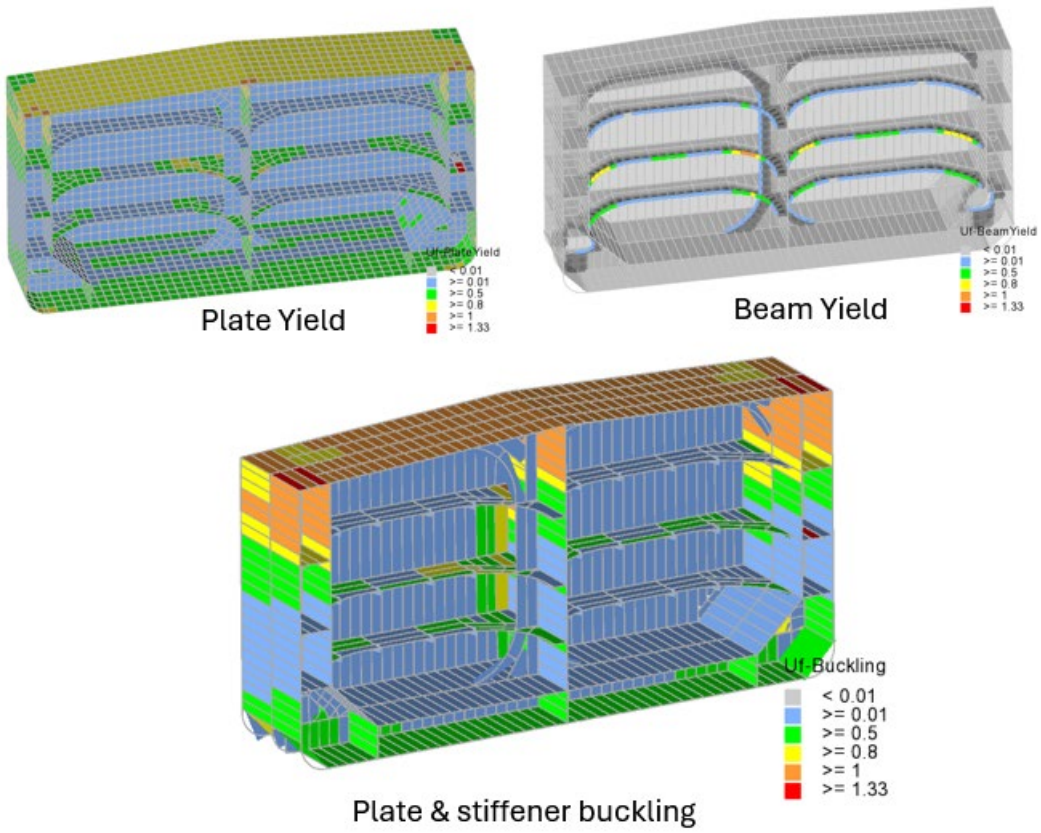


This workshop will explain how to perform plate code check for yield and buckling assessment by DNV Rule. Yield check will be done by DNV-RU-SHIP Pt.3 Ch.7 Sec.3, and buckling will be done by DNV-RU-SHIP Pt.3 Ch.8 Sec.4 / DNV-CG-0128 Sec.3 CFM.

Below programs are used for this tutorial

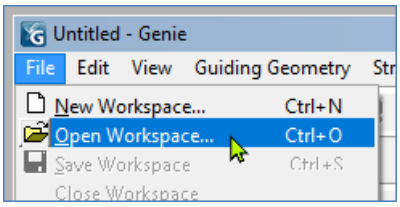
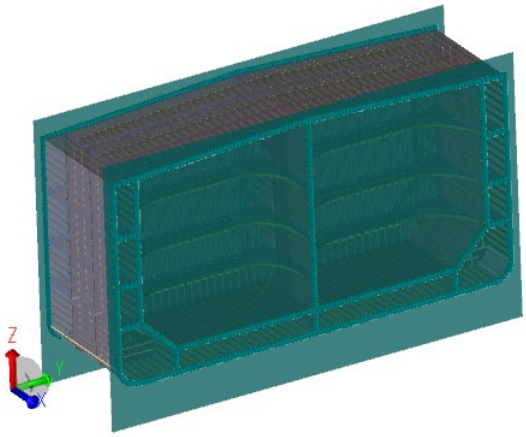
- GeniE 8.12
- Sestra 10.20
- Xtract 6.5

Sesam Example

- Plate Code Check in GeniE by DNV Rule
- Date: July 2025, Revision 1
- Prepared by DNV – Digital Solutions
  Email support: software.support@dnv.com
  Email sales: software@dnv.com

1 MODEL PREPARATION AND RUN ANALYSIS

1.1 Open GeniE model

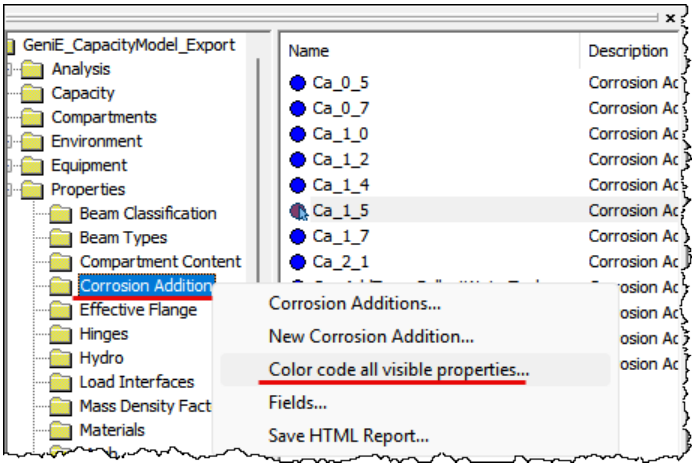
• Open GeniE	
• open "**Plate_Code_Check_DNV.gnx**" in "File → Open Workspace"  Then model will be displayed as shown right.	

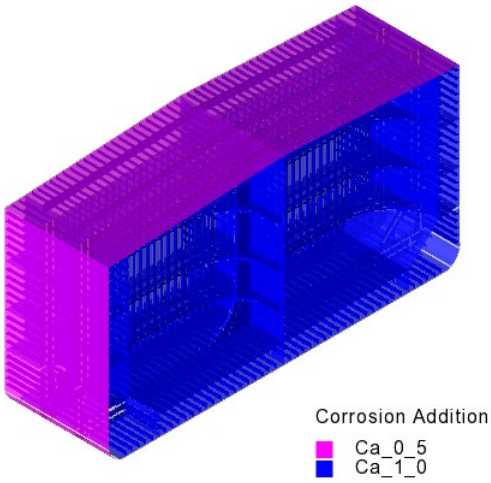
1.2 Check Model – Corrosion Additoin, Structure Type

1.2.1 Color Code for Corrosion Addition Property

Corrosion value will be used during the buckling evaluation.

- Activate "Color Code" to check how the **corrosion additions** are assigned to structural members.

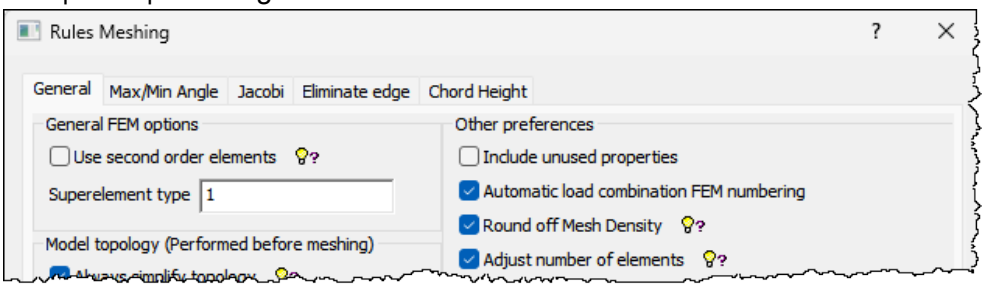


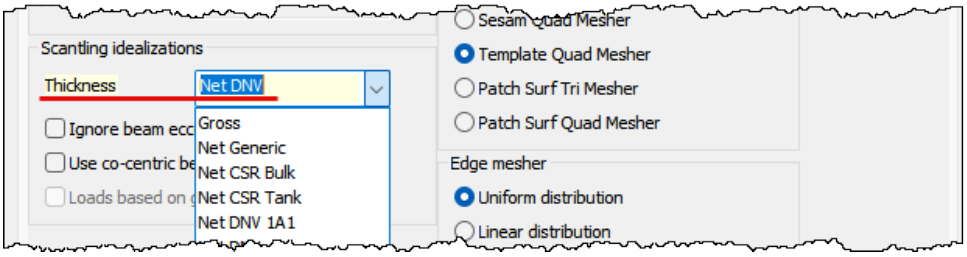


1.2.2 Color Code for Corrosion Rule

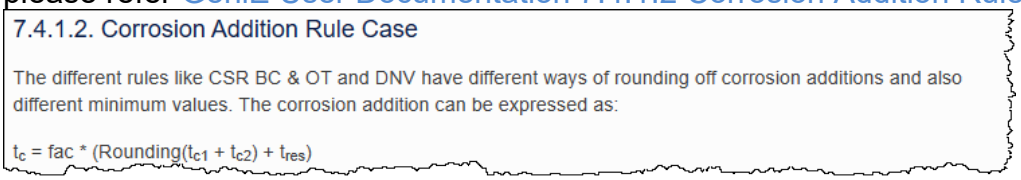
Corrosion rule, to determine how the corrosion values are applied to mesh, is defined in **Edit | Rule | Meshing Rule → Scantling Idealizations | Thickness**.

- Edit | Rule | Meshing Rule





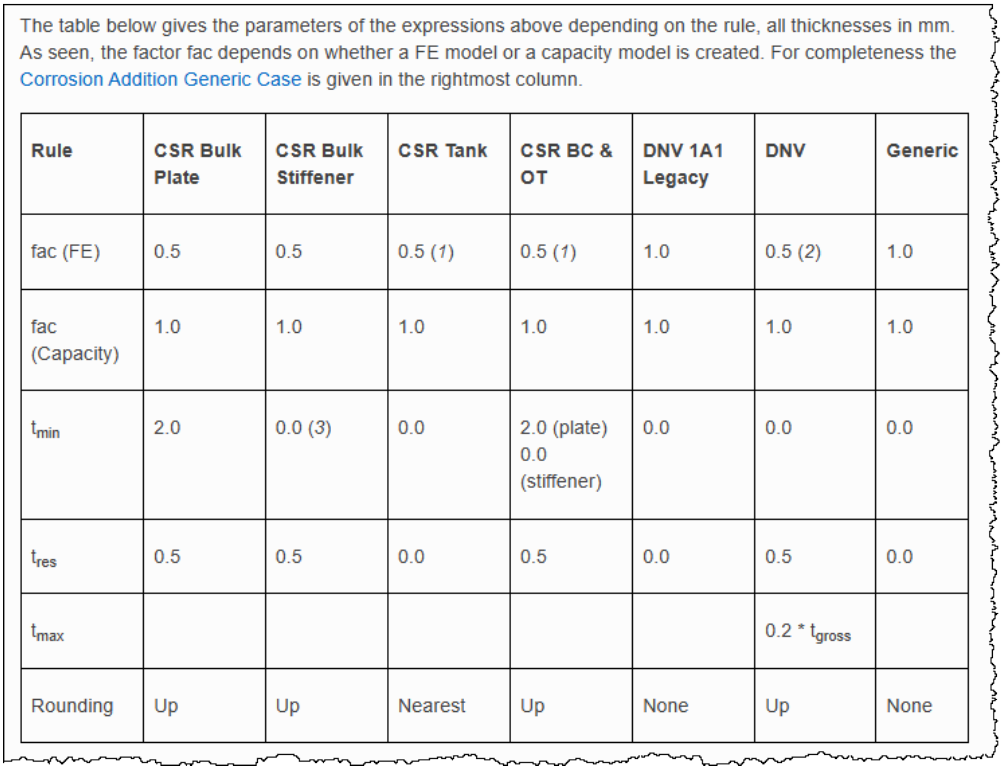
- Now it's defined as "**Net DNV**"
- For detail information, how GeniE applies the corrosion addition properties to mesh, please refer GeniE User Documentation 7.4.1.2 Corrosion Addition Rule Case.



7.4.1.2. Corrosion Addition Rule Case

The different rules like CSR BC & OT and DNV have different ways of rounding off corrosion additions and also different minimum values. The corrosion addition can be expressed as:

$t_c = fac * (Rounding(t_{c1} + t_{c2}) + t_{res})$



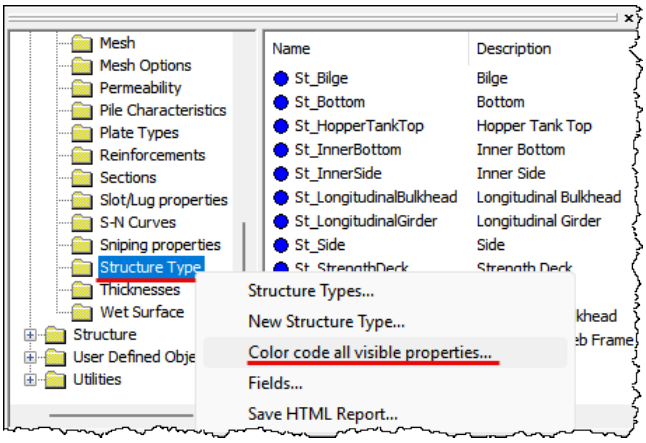
The table below gives the parameters of the expressions above depending on the rule, all thicknesses in mm. As seen, the factor fac depends on whether a FE model or a capacity model is created. For completeness the Corrosion Addition Generic Case is given in the rightmost column.

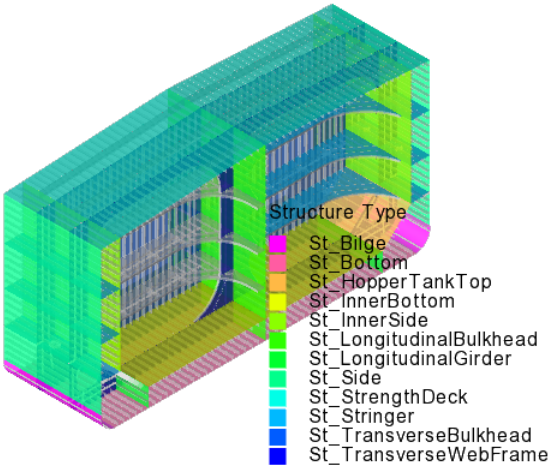
Rule	CSR Bulk Plate	CSR Bulk Stiffener	CSR Tank	CSR BC & OT	DNV 1A1 Legacy	DNV	Generic
fac (FE)	0.5	0.5	0.5 (*1*)	0.5 (*1*)	1.0	0.5 (*2*)	1.0
fac (Capacity)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
t_{min}	2.0	0.0 (*3*)	0.0	2.0 (plate) 0.0 (stiffener)	0.0	0.0	0.0
t_{res}	0.5	0.5	0.0	0.5	0.0	0.5	0.0
t_{max}						0.2 * t_{gross}	
Rounding	Up	Up	Nearest	Up	None	Up	None

1.2.3 Color Code for Structure Type

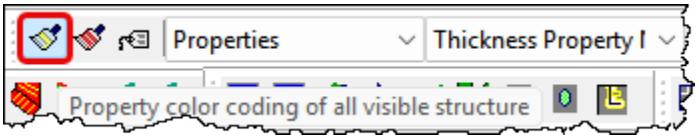
The Structure type is to be used to automatically determine “Buckling Type Method”, whether the panel type is SP-A, SP-B, UP-A, UP-B. User can manually change it locally later, so it’s not mandatory.

- Activate “Color Code” to check how the **Structype Types** are assigned to structural members.





- To turn off the color code, please click “Property color coding” button

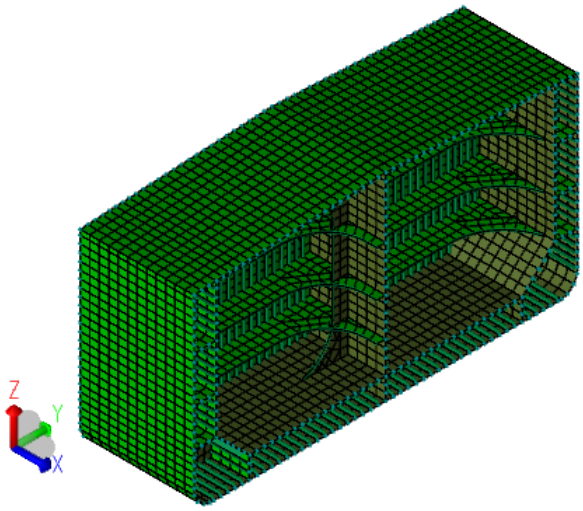


1.3 Check Model – 2D plate mesh

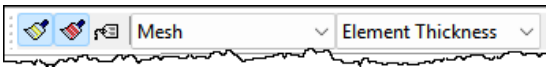
1.3.1 Check Mesh

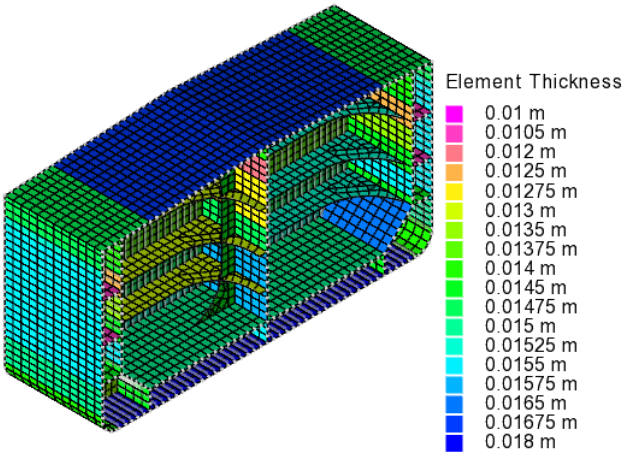
- Change view into “**Mesh – All**”

- Check mesh



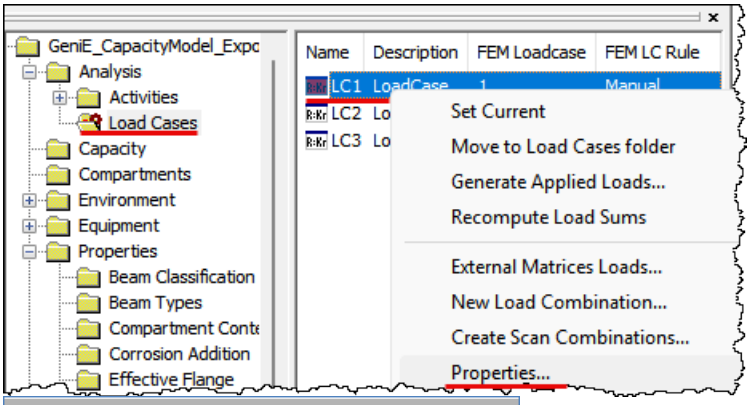
- User may check model by color coding, too. For example, “Element Thickness” can be displayed as like right picture.



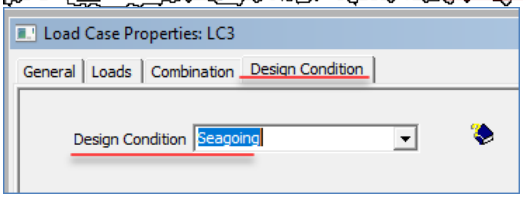


1.4 Check Design Condition

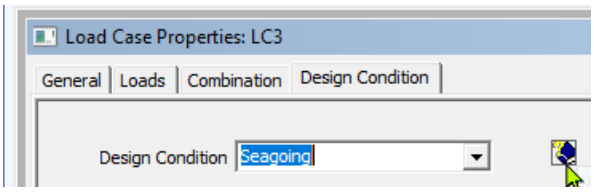
- Enter **property** of load case.

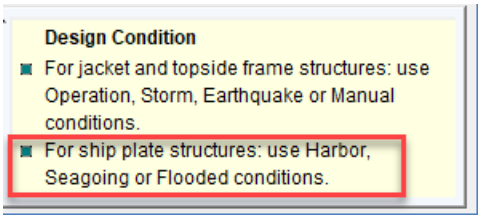


- Then check “Design Condition” in “Design Condition” tab. Currently it’s defined as below
  - LC1, LC2 : **Seagoing**
  - LC3 : **Harbour**



- This will be related to evaluation criteria, mentioned in “**2.1.3 Add Run**” & “**2.2.3 Add Run**”
- For DNV (or CSR BC OT) rule, “**Harbor, Seagoing, or Flooded**” condition can be used.

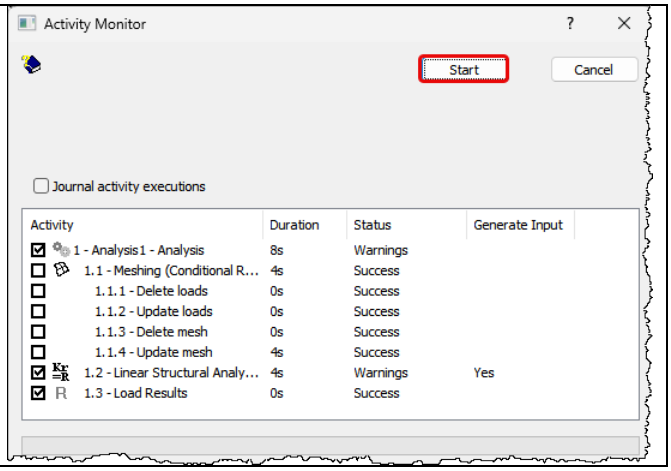




1.5 Run structural analysis

Now it’s ready to run the analysis.

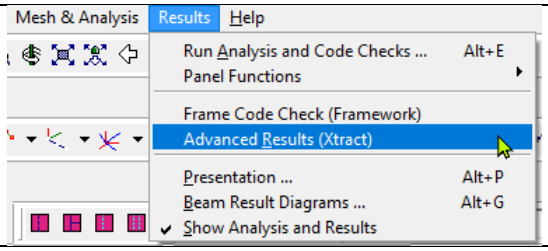
- Open “**Activity Monitor**” by “**Alt+D**”
- “**Start**” Analysis



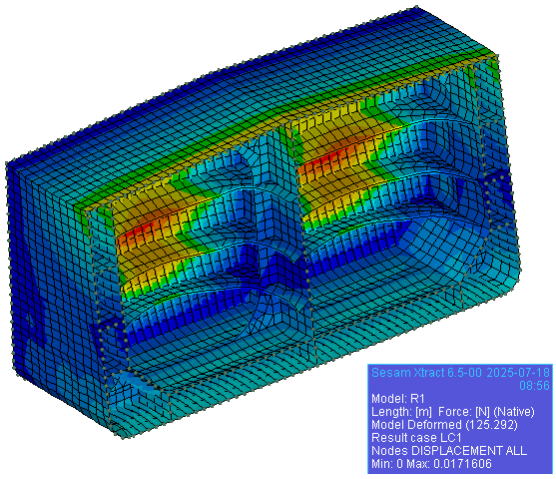
1.6 Check Analysis result in Xtract

Check the analysis result in Xtract. Displacements, deformation shape, and applied loads and stress components, and so on.

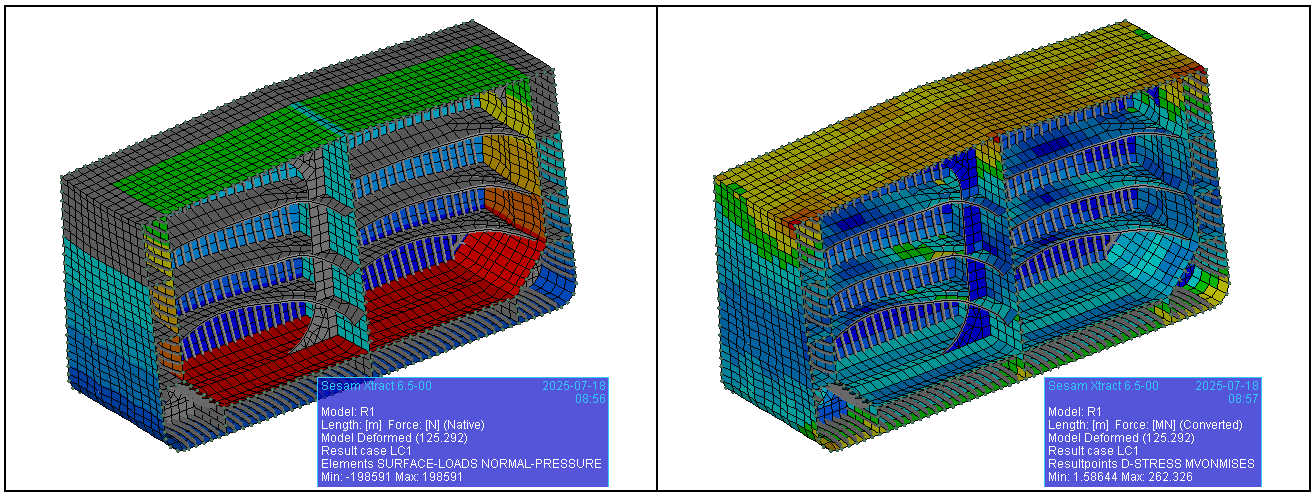
- Open Xtract in “**Result → Advanced Result (Xtract)**”



- Check analysis result in Xtract. Below is deformation of LC1 case.



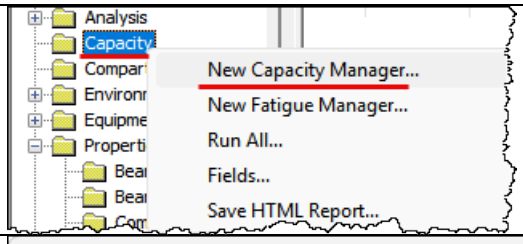
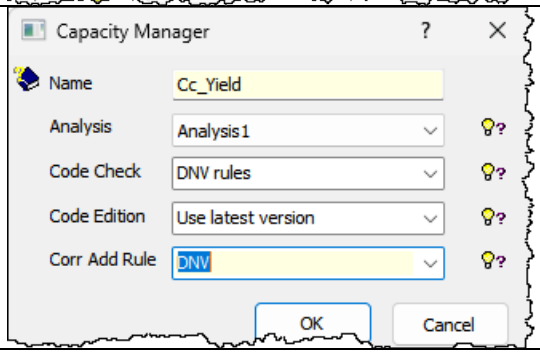
- Normal pressure for load load case (**ELEMENT | SURFACE-LOADS | NORMAL-PRESSURE**)
- Von-mises stress for load combination case (**Resultpoints | D-STRESS | MVONMISES**)


Sesam Xtract 6.5-00
2025-07-18
08:58
Model: R1
Length: [m] Force: [N] (Native)
Model Deformed (125.292)
Result case LC1
Elements SURFACE-LOADS NORMAL-PRESSURE
Min: -198591 Max: 198591
Sesam Xtract 6.5-00
2025-07-18
08:57
Model: R1
Length: [m] Force: [MN] (Converted)
Model Deformed (125.292)
Result case LC1
Resultpoints D-STRESS MVONMISES
Min: 1.58644 Max: 262.326

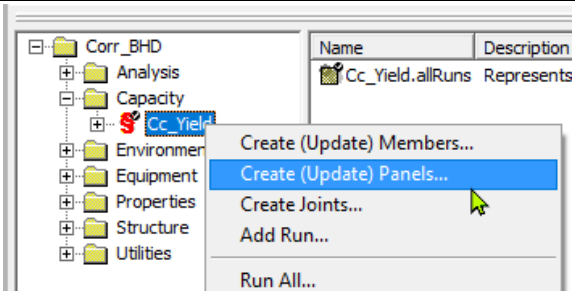
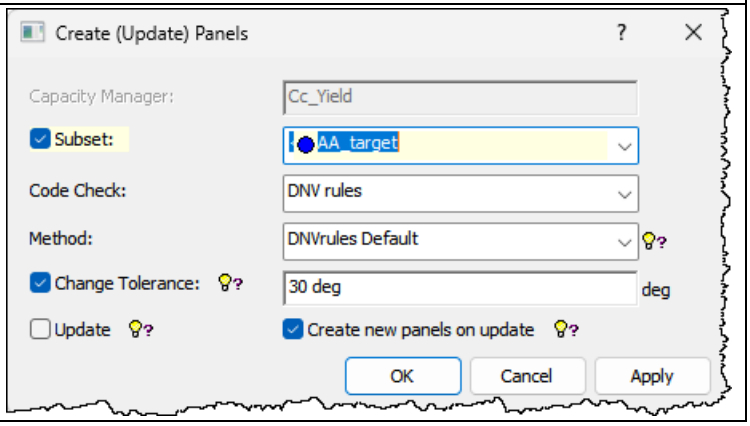
2 STRENGTH EVALUATION

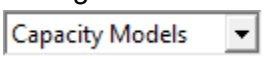
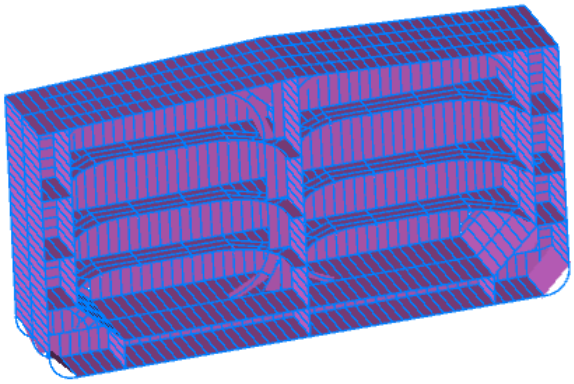
2.1 Yield Strength Evaluation

2.1.1 Create Capacity Manager

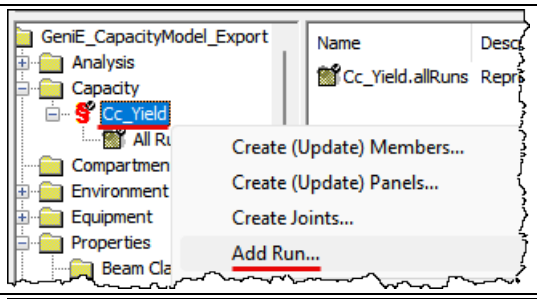
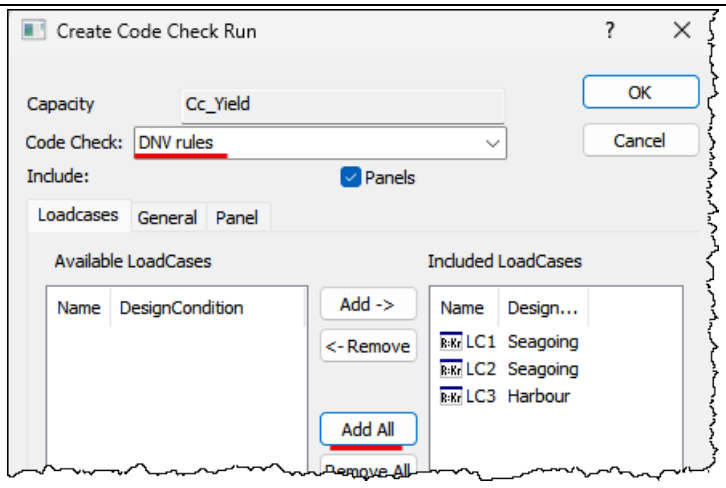
• Create new capacity manager in "**New Capacity Manager**"	
• Setting as below ○ Name : **Cc_Yield** ○ Analysis : **Analysis1** ○ Code Check : **DNV rules** ○ Corr Add : **DNV**	

2.1.2 Create Panel

• "**Create (Update) Panel**"	
• Subset : "**AA_target**"	

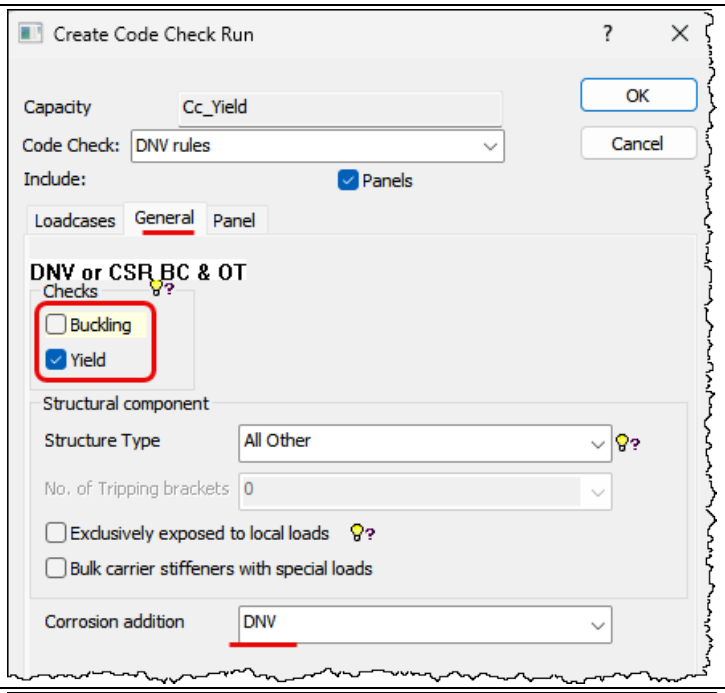
• Change view into “**Capacity Models**”  to see whether capacity panel has been created well.	

2.1.3 Add Run

• “**Add Run**”	
For “**Loadcase**” tab • Code Check : **DNV Rule** • Click “**Add All**” for included loadcase	

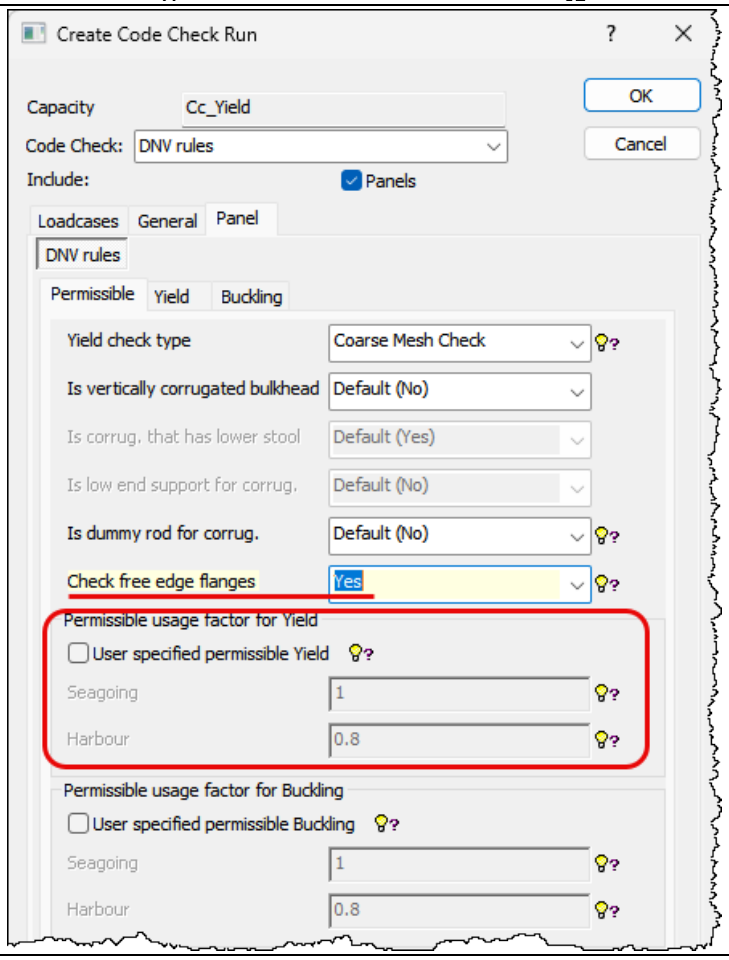
For “**General**” tab

- Select “**Yield**” (exclude “Buckling”)
- Structure Type : “**All Others**”
- Check “**DNV**” is selected for corrosion addition.



For “**Panel | Permissible**” tab

- Change “**Check Free edge flanges**” as “**Yes**” and also check other options.
- Also it’s important to check permissible criteria, especially for “**Permissible Yield**” for this moment.



- Below is criteria for **Yield** in DNV-RU-SHIP Pt.3, for reference. Seagoing can be considered "S+D" component, while "Harbour" can be considered as "S".

Table 1 Permissible coarse mesh yield utilisation factor λ_{yperm}

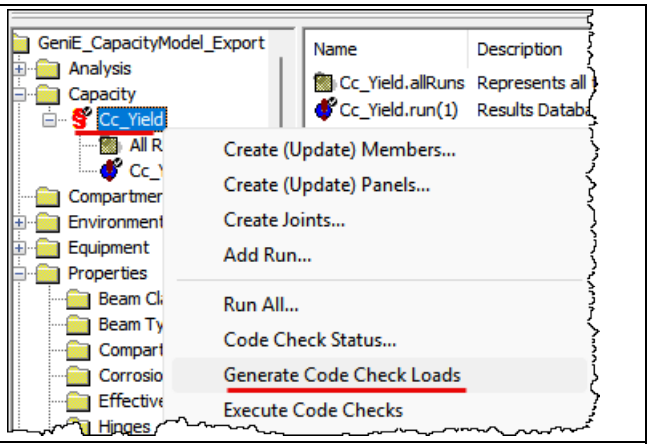
Structural member	*Acceptance criteria*	*Load components*[2)]	λ_{yperm}
Plating of all longitudinal hull girder structural members, primary supporting structural members and bulkheads. Dummy rod of corrugated bulkhead. Face plate of primary supporting members modelled using shell or rod elements.	AC-I	S	0.8[(3)]
	AC-II	S + D	1.0
	AC-III[(1)]	A, T	1.00
Corrugation of corrugated bulkheads under lateral pressure from liquid loads, for shell elements only. For corrugation angle between 45° and 55° the reduction in λ_{yperm} as given in Ch.3 Sec.6 [6.1.1] applies.	AC-I	S	0.72[(4)]
	AC-II	S + D	0.90
	AC-III[(1)]	A, T	0.90

1) For members of the collision bulkhead, AC-I shall be used.
2) See Ch.1 Sec.2 [4.2].
3) λ_{yperm} = 0.85 when hull girder permissible loads for harbour operations or special operations are applied.
4) λ_{yperm} = 0.77 when hull girder permissible loads for harbour operations or special operations are applied.

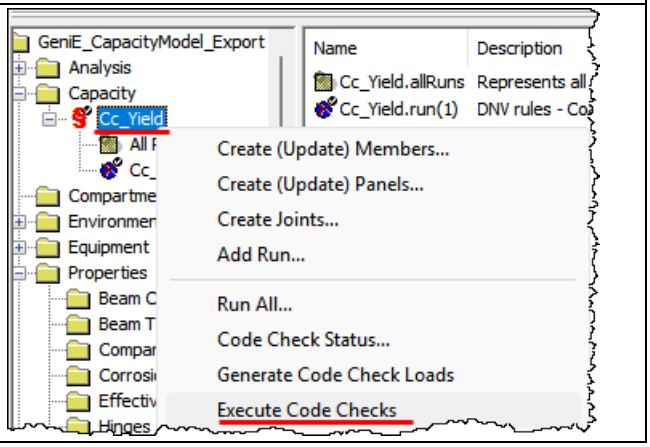
Part 3 Chapter 7 Section 3

2.1.4 Generate Code check * Execute Code Check.

- "**Generate Check check loads**"

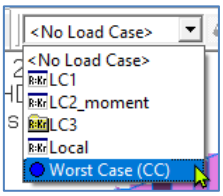


- "**Execute Code Checks**"



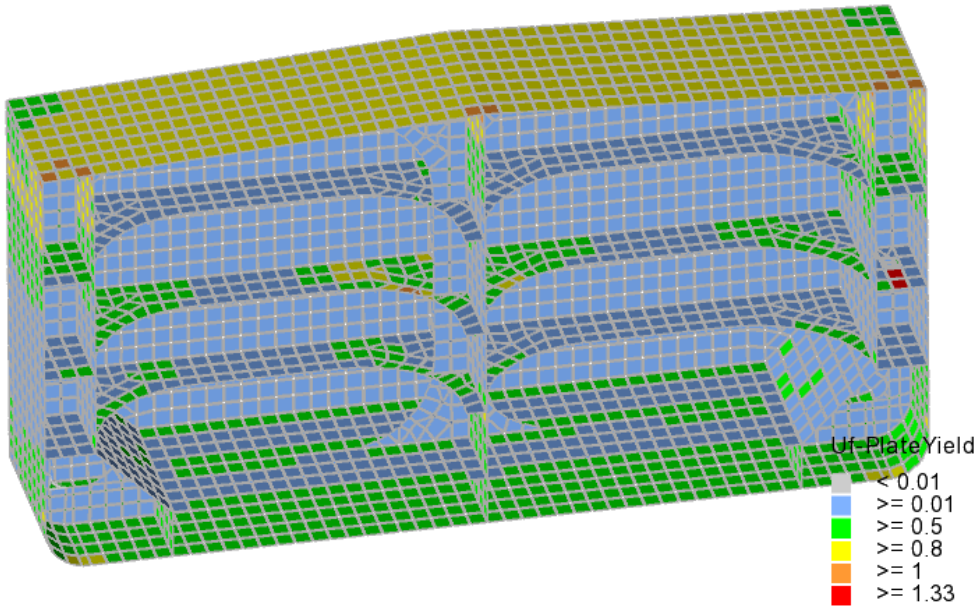
2.1.5 Check Yield result of Plate

- Change load case into "**Worst Case(CC)**"



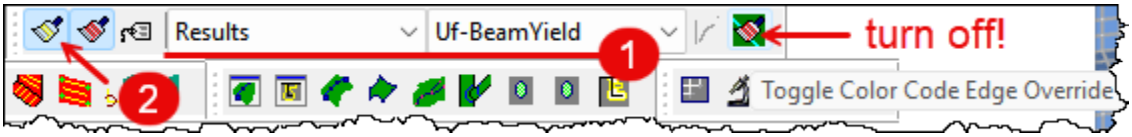
- Select "**Result → Uf-PlateYield**" → then activate color code for that

- Then Plate Yield can be displayed as below.



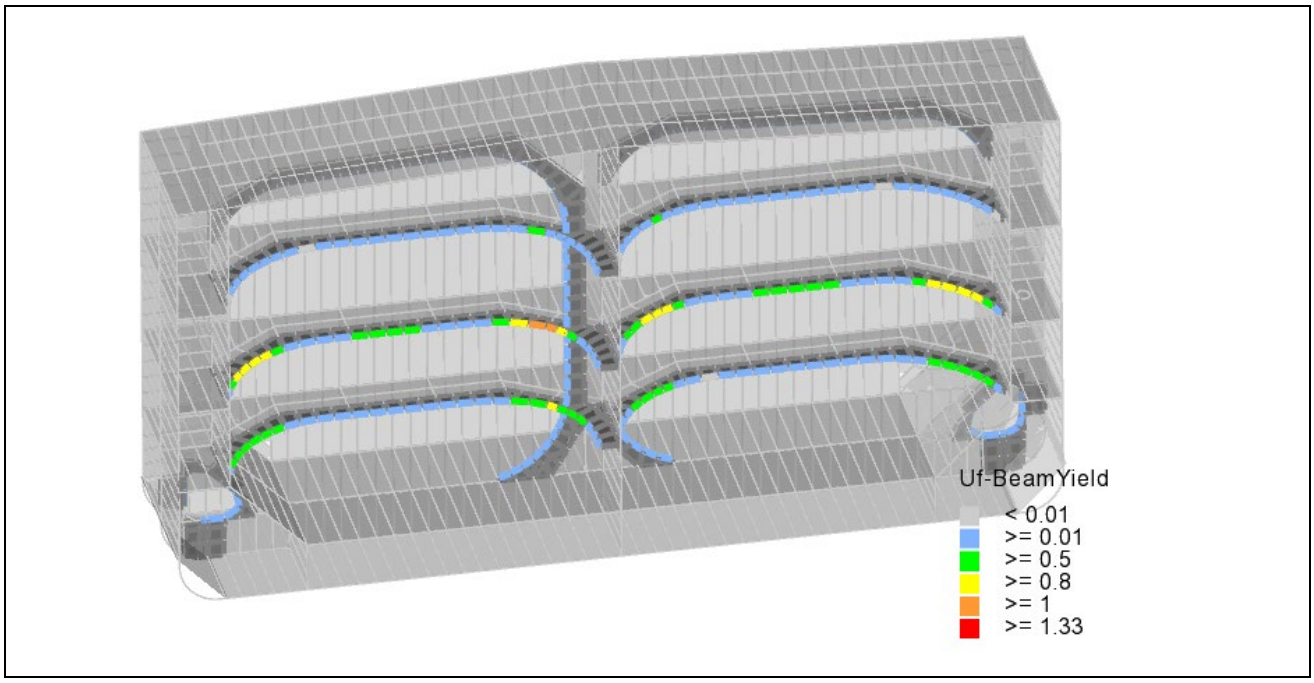
2.1.6 Check Yield result of Dummy Beam

- Select "**Result → Uf Beam Yield**"



(Toggle color code edge override should be turned off)

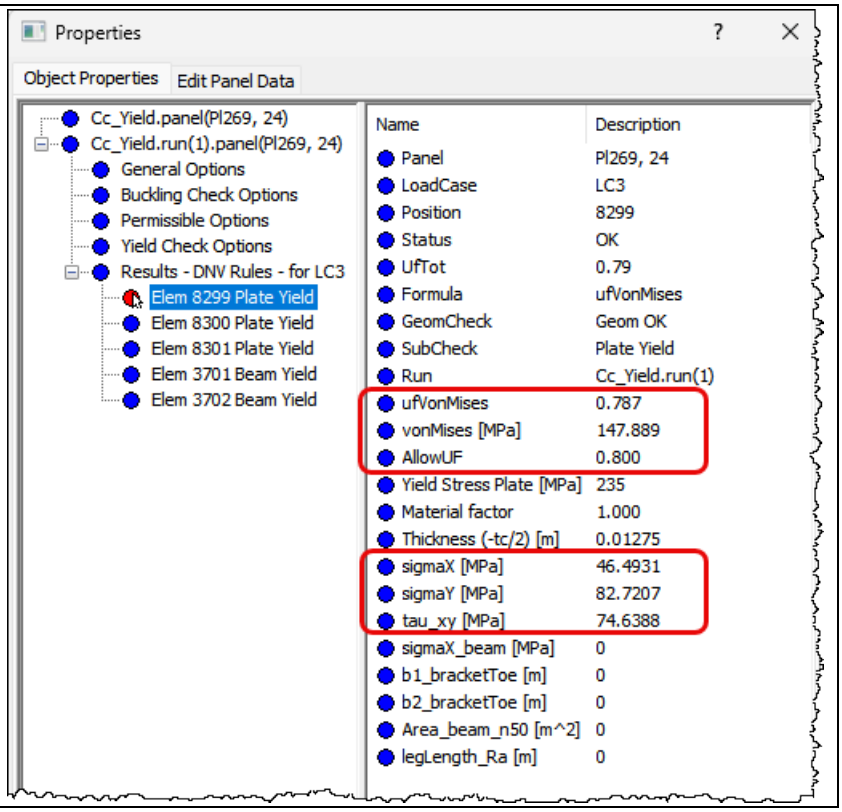
- Then yield for dummy rod can be checked.



2.1.7 Check detail result of yield result

- Select 1 panel → **Properties**

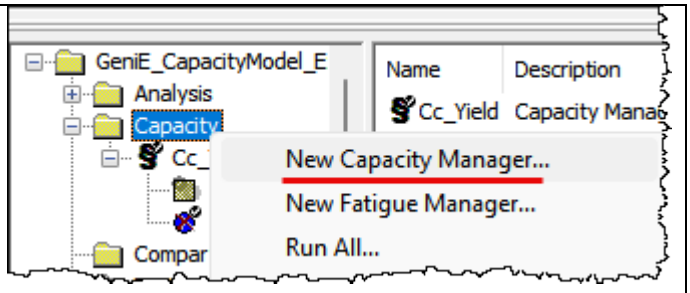
- Then select one element (“8299” is element number.)
- Check whether criteria is correct, and each check stress component, if want.



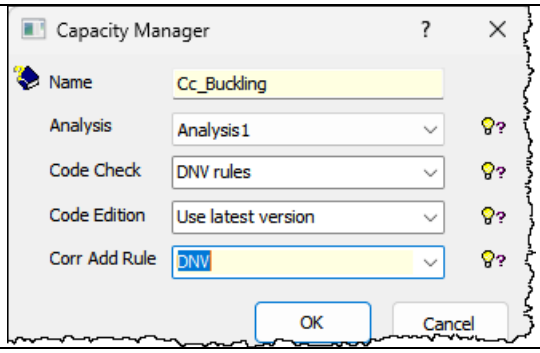
2.2 Buckling Strength Evaluation

2.2.1 Create Capacity Manager

- Create new capacity manager in "**New Capacity Manager**"

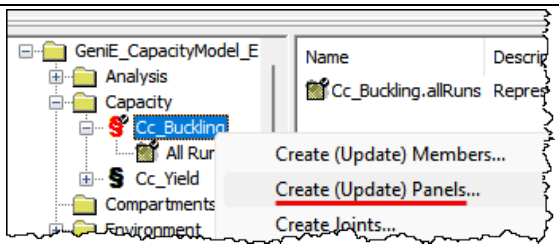


- Setting as below
  - Name : **Cc_Buckling**
  - Analysis : **Analysis1**
  - Code Check : **DNV rules**
  - Corr Add : **DNV**

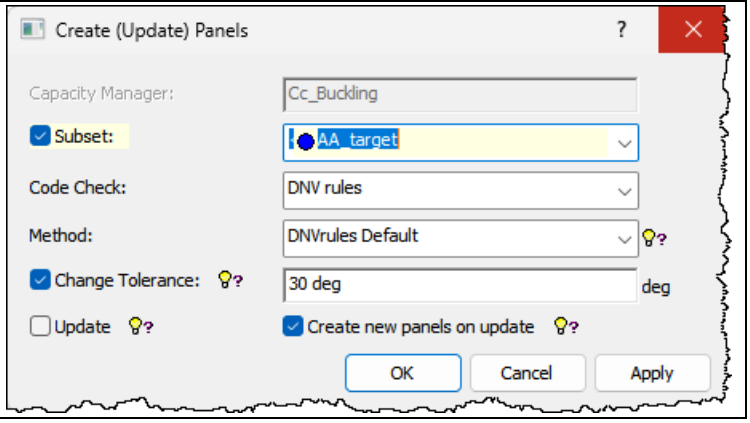


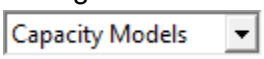
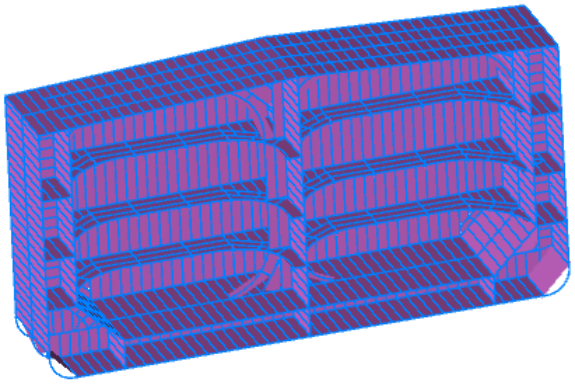
2.2.2 Create Panel

- "**Create (Update) Panel**"

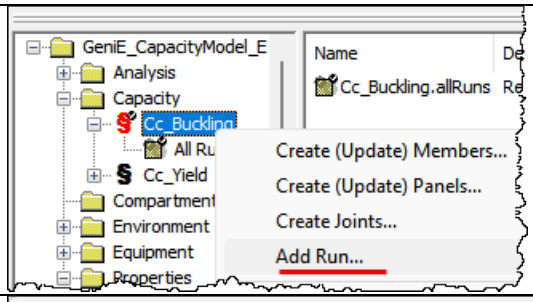
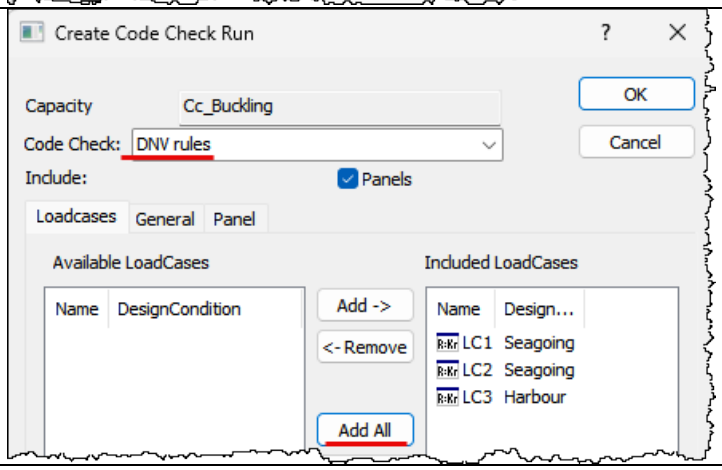


- Subset : "**AA_target**"



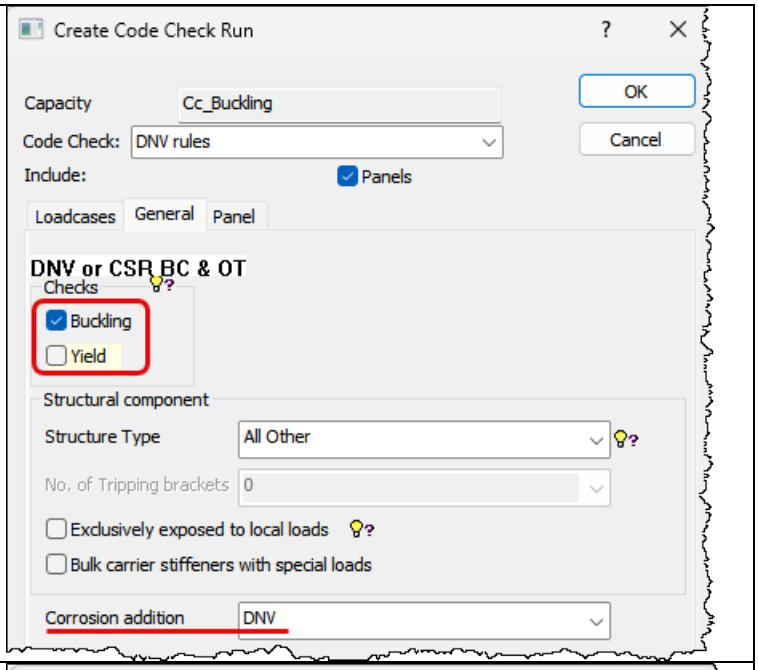
• Change view into “**Capacity Models**”  to see whether capacity panel has been created well.	

2.2.3 Add Run

• “**Add Run**”	
For “**Loadcase**” tab • Code Check : **DNV Rule** • Click “**Add All**” for included loadcase	

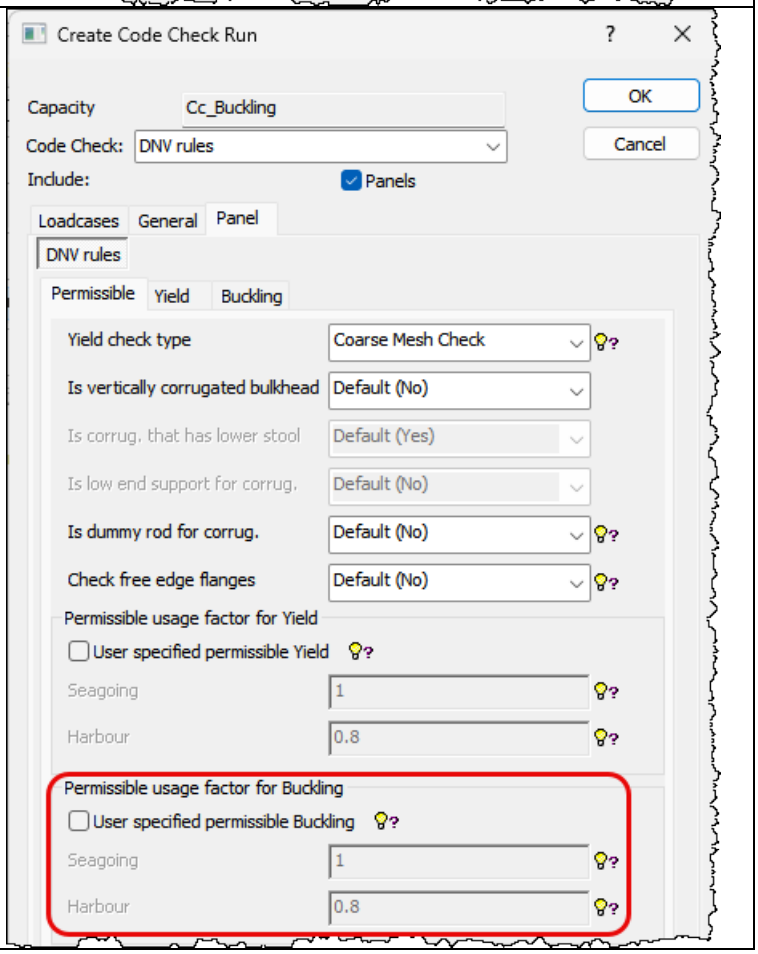
For “**General**” tab

- Select “**Buckling Only**”
- Structure Type : “**All Others**”
- Corrosion Addition : **DNV**

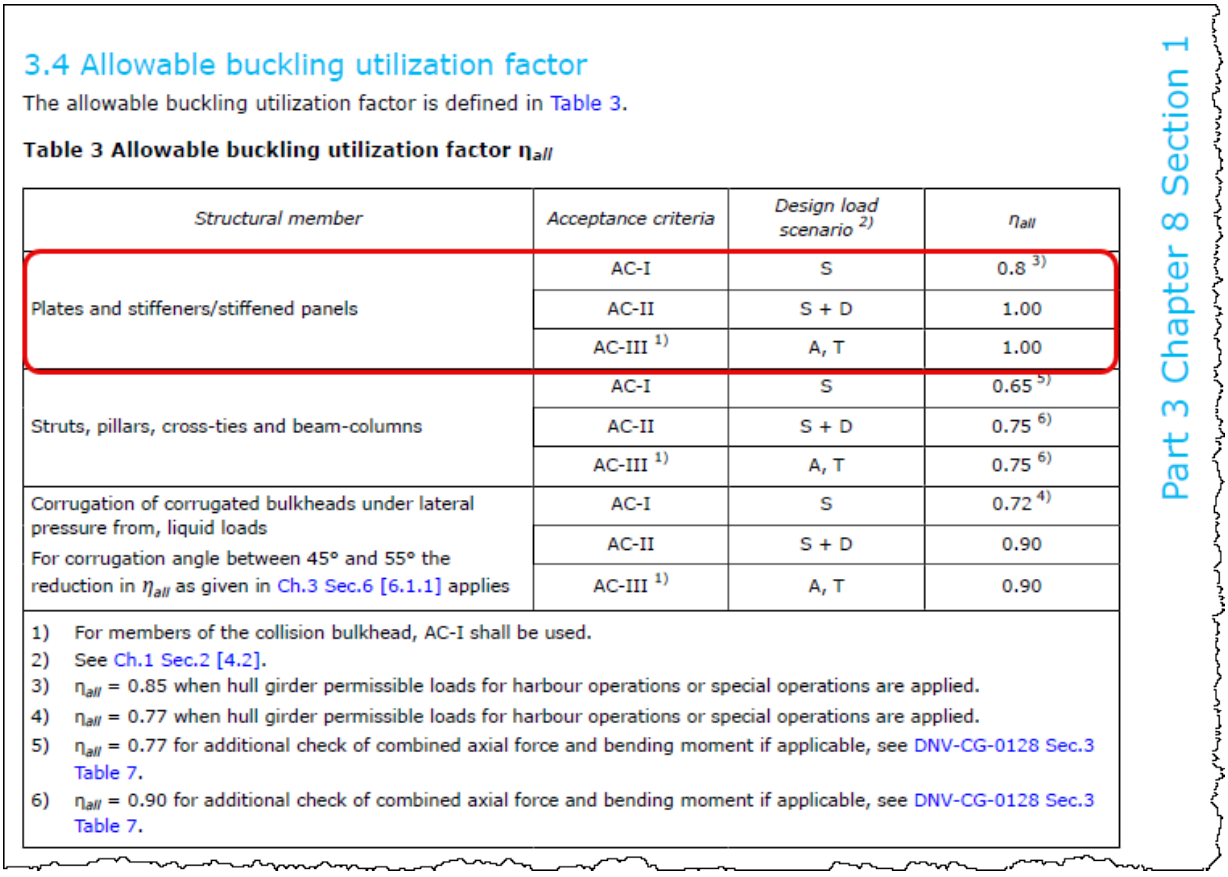


For “**Panel | Permissible**” tab

- Check whether proper options are selected in “Permissible” tab.
- Also it’s important to check permissible criteria, especially for “**Permissible Buckling**” for this moment.



- Below is criteria for **Buckling** in DNV-RU-SHIP, for reference



Part 3 Chapter 8 Section 1

3.4 Allowable buckling utilization factor

The allowable buckling utilization factor is defined in Table 3.

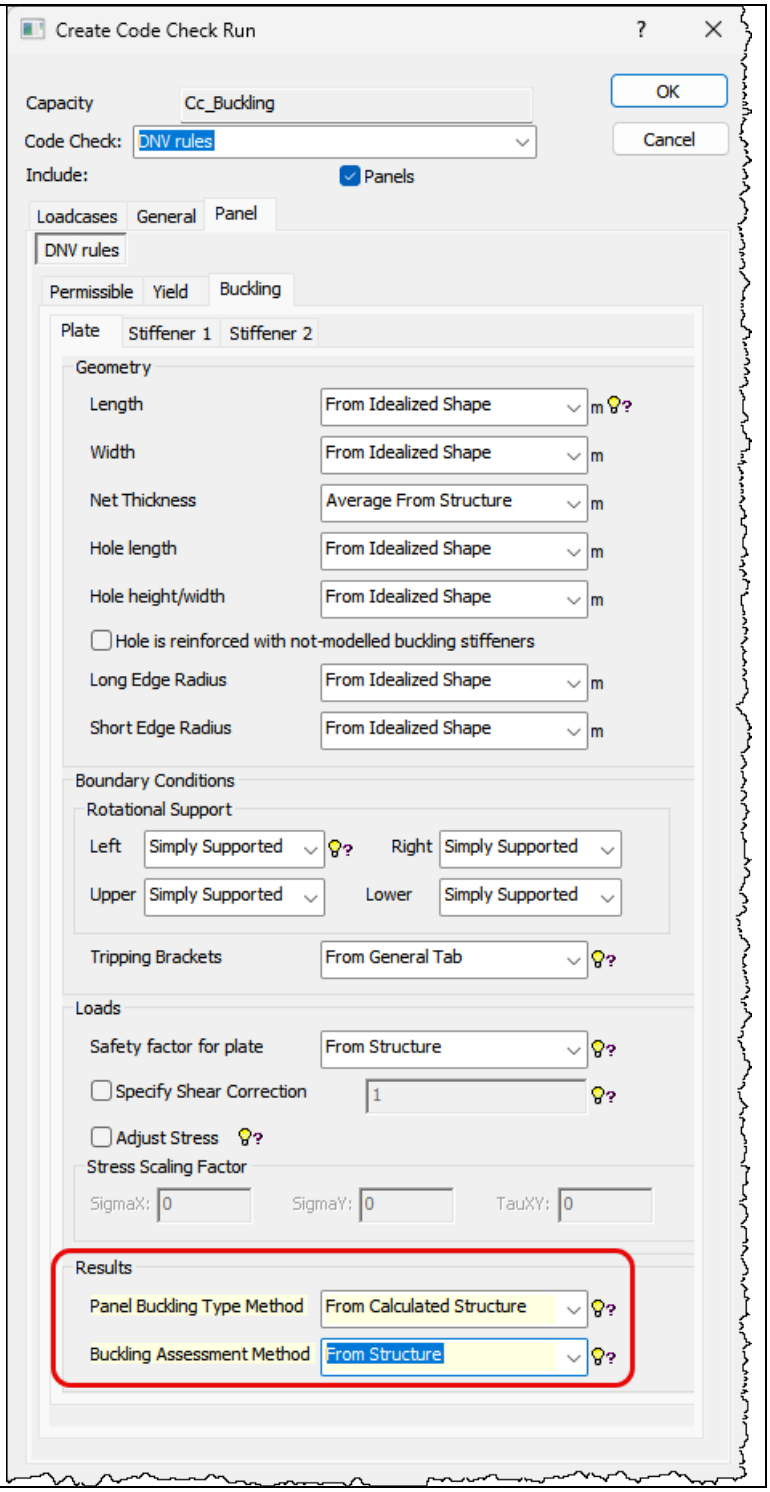
Table 3 Allowable buckling utilization factor η_{all}

Structural member	*Acceptance criteria*	*Design load scenario* [2]	η_{all}
Plates and stiffeners/stiffened panels	AC-I	S	0.8 [3]
	AC-II	S + D	1.00
	AC-III [1]	A, T	1.00
Struts, pillars, cross-ties and beam-columns	AC-I	S	0.65 [5]
	AC-II	S + D	0.75 [6]
	AC-III [1]	A, T	0.75 [6]
Corrugation of corrugated bulkheads under lateral pressure from, liquid loads For corrugation angle between 45° and 55° the reduction in η_{all} as given in Ch.3 Sec.6 [6.1.1] applies	AC-I	S	0.72 [4]
	AC-II	S + D	0.90
	AC-III [1]	A, T	0.90

1) For members of the collision bulkhead, AC-I shall be used.
2) See Ch.1 Sec.2 [4.2].
3) η_{all} = 0.85 when hull girder permissible loads for harbour operations or special operations are applied.
4) η_{all} = 0.77 when hull girder permissible loads for harbour operations or special operations are applied.
5) η_{all} = 0.77 for additional check of combined axial force and bending moment if applicable, see DNV-CG-0128 Sec.3 Table 7.
6) η_{all} = 0.90 for additional check of combined axial force and bending moment if applicable, see DNV-CG-0128 Sec.3 Table 7.

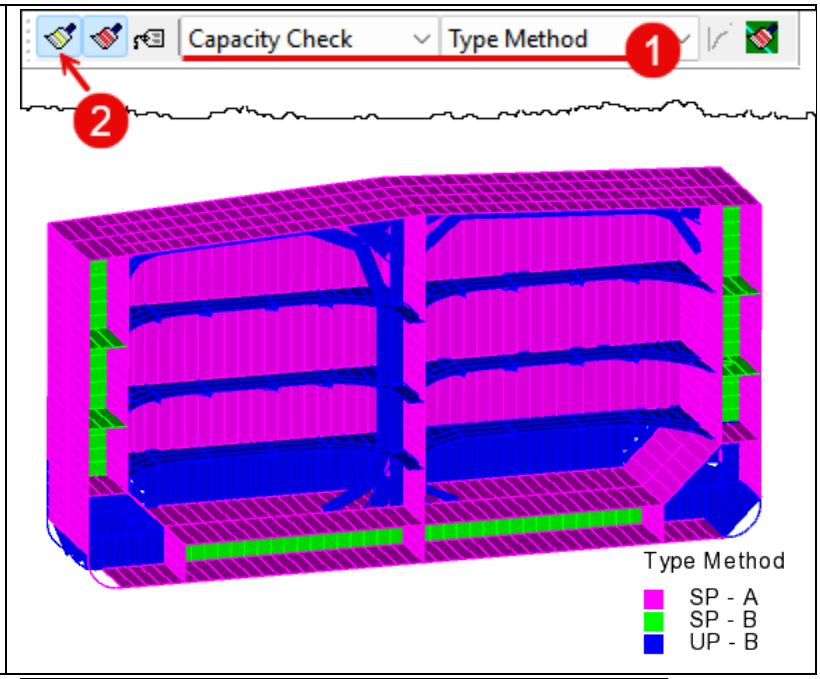
For “**Panel | Buckling**” tab

- One of the main setting here is to define “**Buckling Type Method**”
- In case, “Structural Type” are defined, user may select “**From calculated Structure**” / “**From Structure**” option. Then GeniE will determine “Buckling Type Method” automatically.
  - But this automatic function may need check and manual update for some panels.
- This is kind of “Global” setting. User can change them “Locally” later.

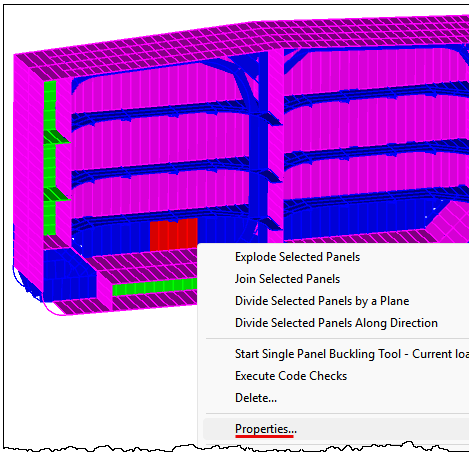


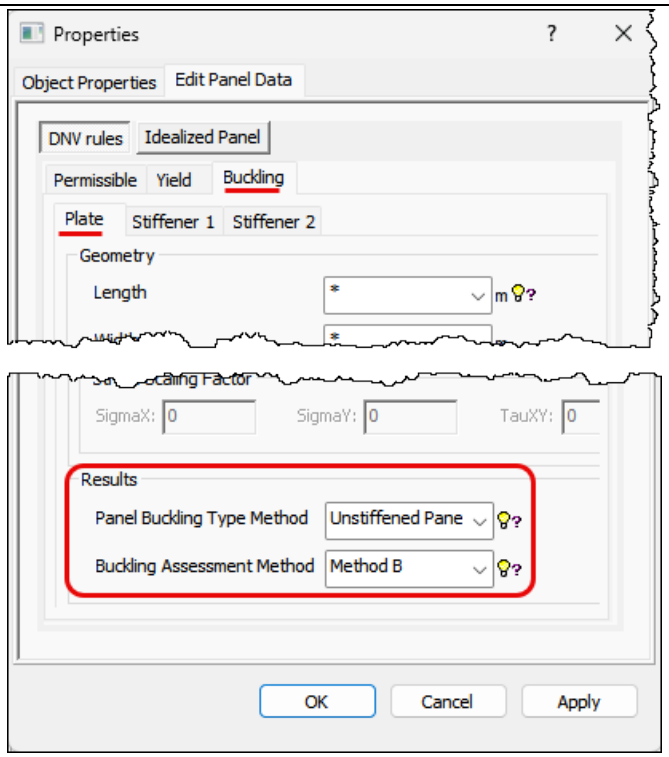
2.2.4 Check Buckling Type Method & Corrosion

- Activate color code for “**Capacity Check | Type Method**”



- Update “Type Method” if needed. This can be done by entering “Properties” of panel



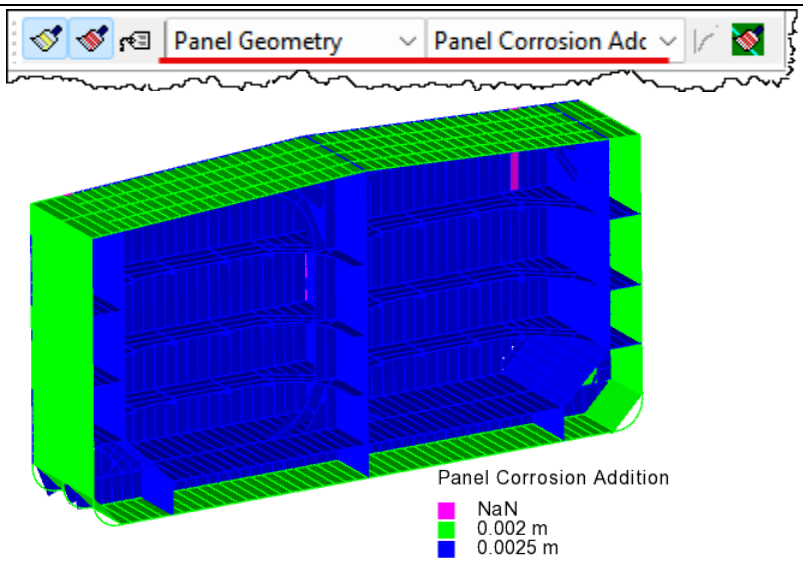


- If “sets” for each “Type Method” are already defined, then user may use script “**Change_Buckling_Type_Method_v05_Simple.js**”, which can quickly update type method based on sets.

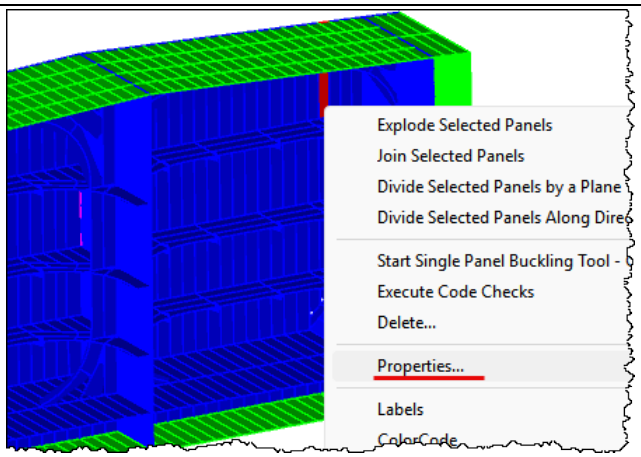
For the definitions of “Buckling Type Method”, please refer to DNV-RU-SHIP Ch.8 Buckling Sec.4-2 Stiffened and unstiffened panels.

It would be also good to check whether final corrosion additional is well determined in panel model.

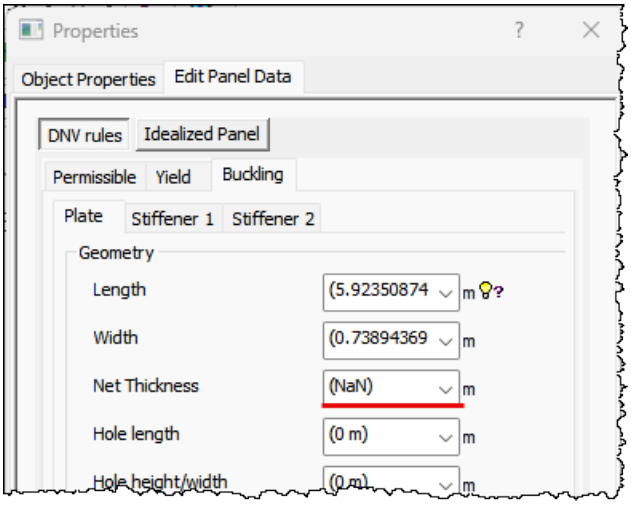
- Activate color code for “**Panel Geometry | Panel Corrosion Addtion**”



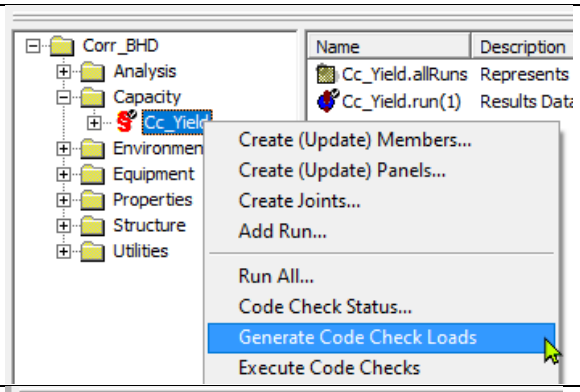
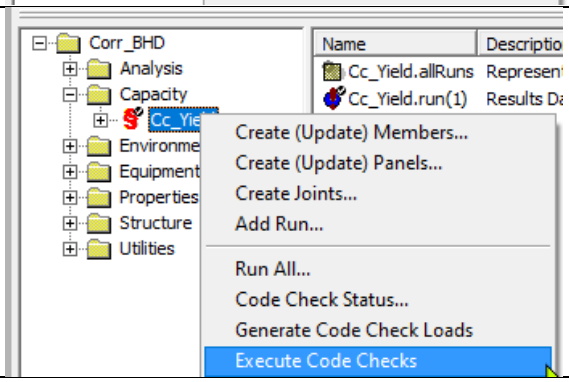
- Update “Corrosion Addition” if needed. This can be done by entering “Properties” of panel



- Then update “Net Thickness” property directly including corrosion.

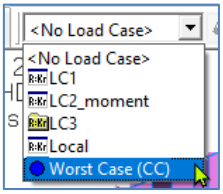


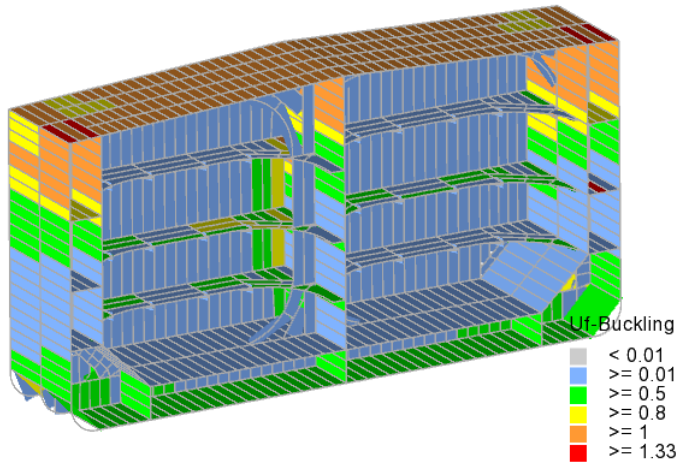
2.2.5 Generate Code check * Execute Code Check.

• "**Generate Check check loads**"	
• "**Execute Code Checks**"	

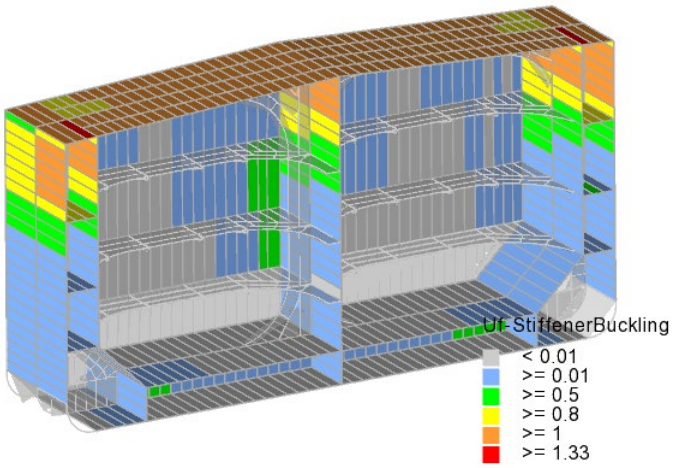
- Then Buckling calculation will be performed, based on DNV-RU-SHIP Ch.8 Sec.4 Buckling requirements for direct strength analysis / DNV-CG-0128 Sec.3 Closed Form Method (CFM).

2.2.6 Check Buckling result of Plate

• Change load case into "**Worst Case(CC)**"	
• Select "**Result → Uf-PlateBuckling**" → then activate color code for that 	
• Then Plate Yield will be color coded.	

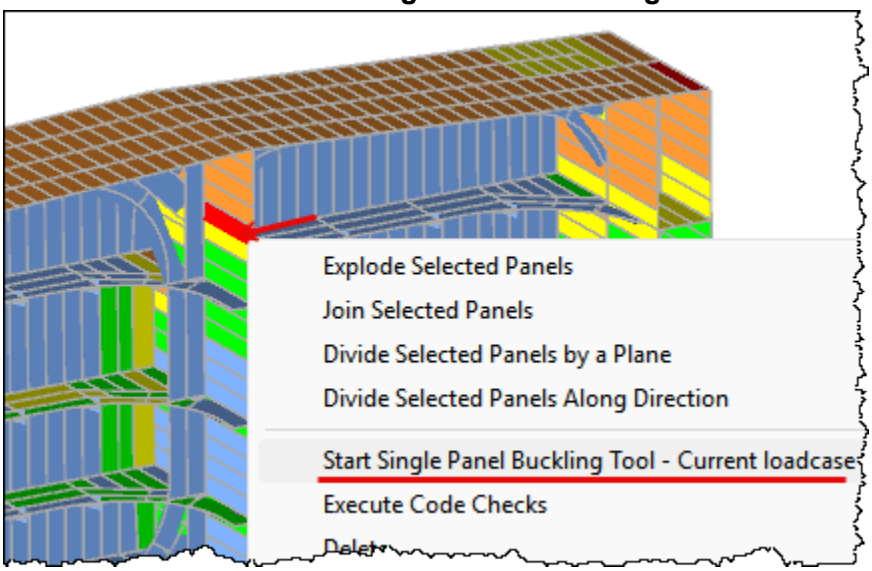


- Stiffener Buckling could be checked too.

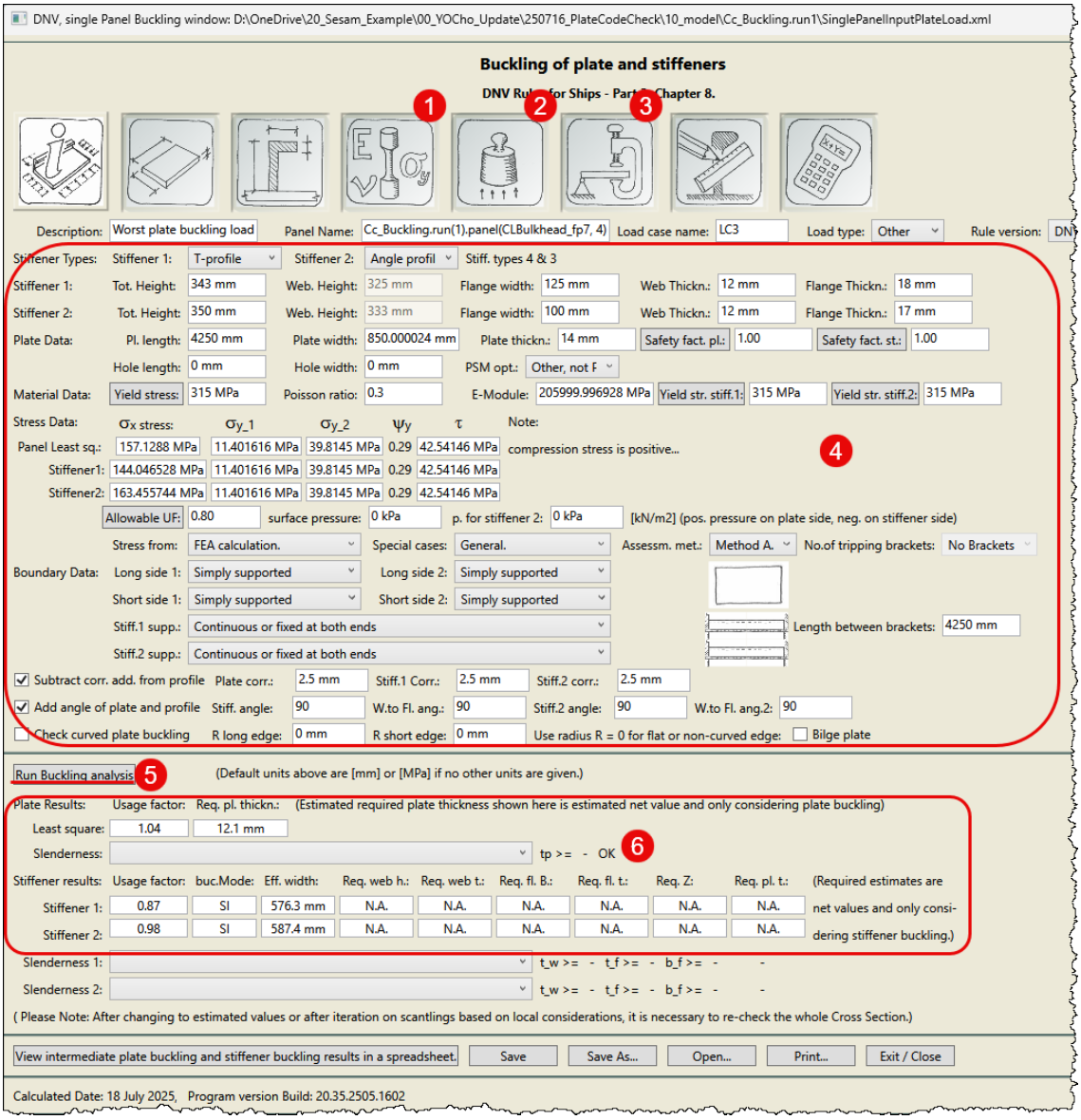


2.2.7 Start Single Panel Buckling Tool (SPBT) for design iteration

- Select one Panel → "**Start Single Panel Buckling Tool**"



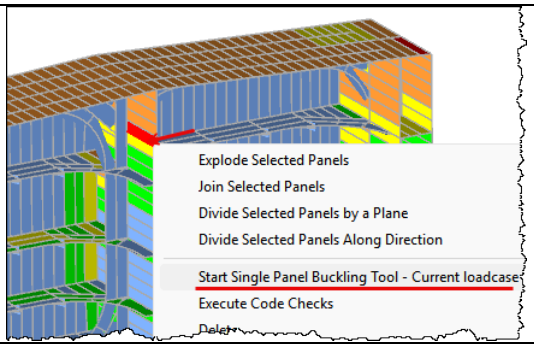
- Press buttons (1), (2), (3) to see the input parameters in detail.



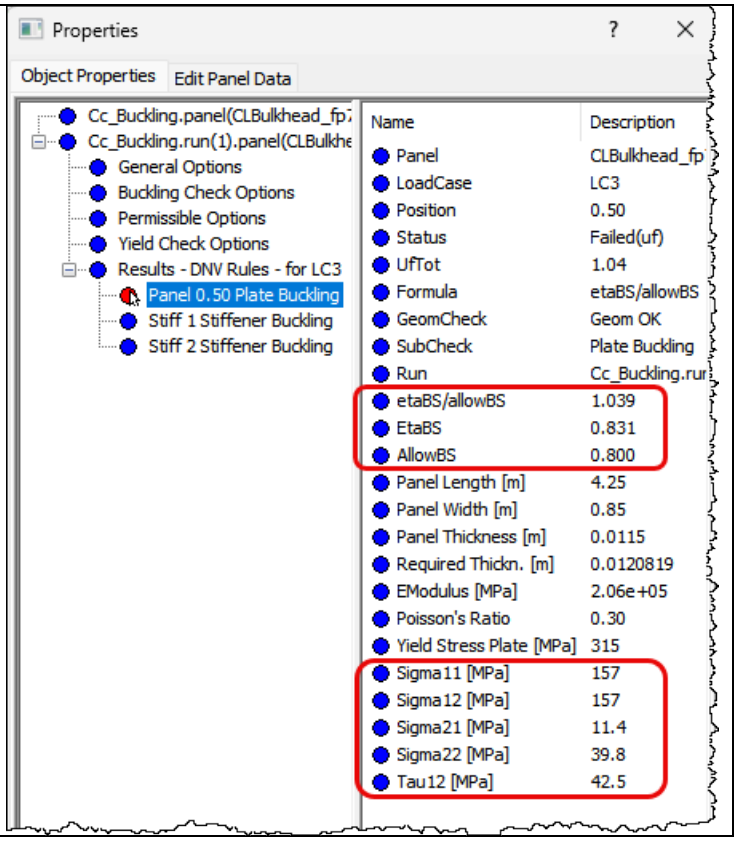
- (4) Modify them for design iteration → (5) run Buckling Analysis → (6) new usage factor will be obtained.

2.2.8 Check detail result of buckling result

- Select 1 panel → **Properties**



- Then select one calculation (panel buckling or stiffener buckling)
- Check whether criteria is correct, and check each stress component, if want.

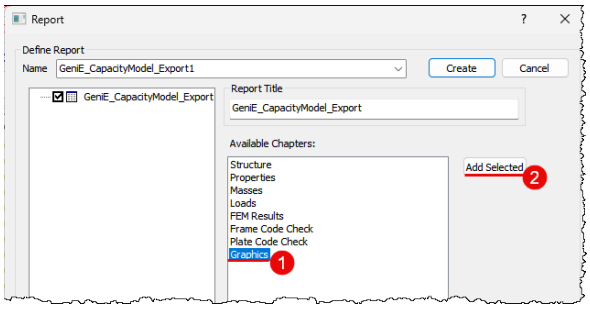


3 MAKING A PLATE CODE CHECK REPORT

The Graphics chapter in the report supports automated creation of plots looping over sets, load cases or worst load case only in the workspace. External pictures can also be added. In the following you will practice adding some typical pictures to a report.

Create a new report:

- **File -> Save Report**
- Name it **Report_CH**

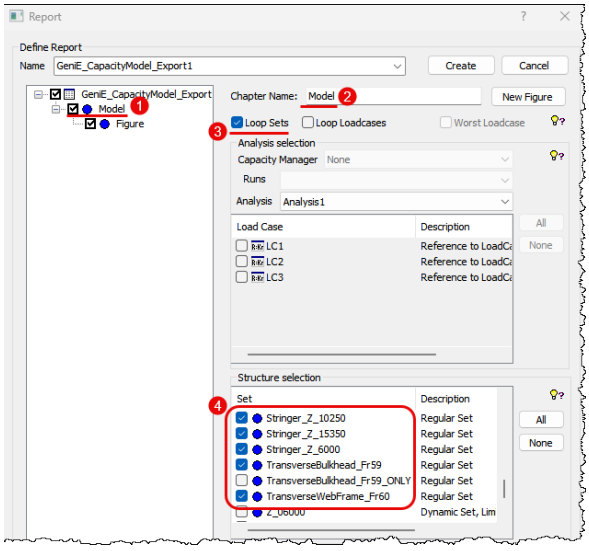


Add a graphics chapter:

- Select **Graphics** in Available Chapters list and click Add Selected
- Click Create

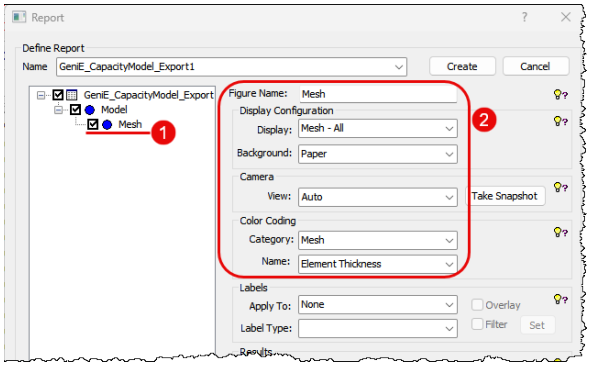
Change **chapter name**:

- Select the Graphics chapter in the tree view
- Change chapter name (to the right) to **Model**
- Press tab key
- **Loop Sets** → Select sets below
  - Stringer_Z_10250
  - Stringer_Z_15350
  - Stringer_Z_6000
  - TransverseBulkhead_Fr59
  - TransverseWebFrame_Fr60



Change **figure name**:

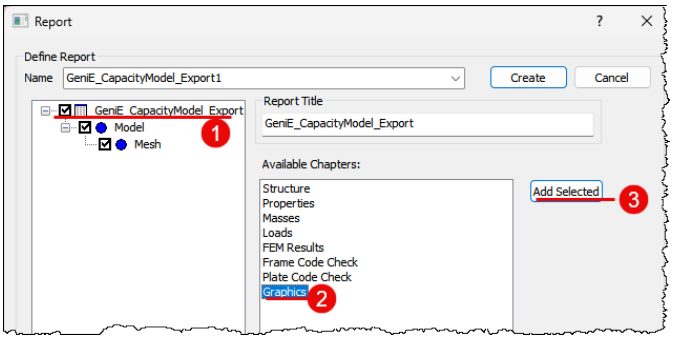
- Select the figure in the tree view
- Change figure name to **Mesh**
- Press tab key or click elsewhere

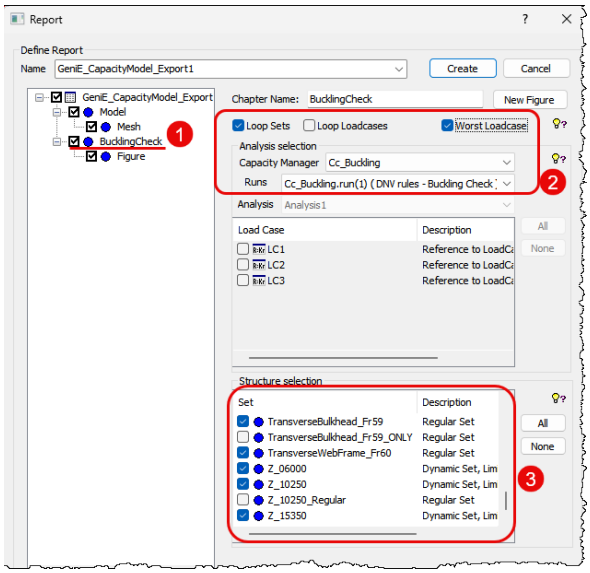


Set options for picture of mesh model:

- Display Configuration
  - **Display = Mesh – All**
  - **Background = Paper**
- Camera
  - **View = Auto**
  - The Auto option is default and will attempt to orientate the model to an axis-aligned camera such that "flattest" side is facing the viewer. If there is no "flattest" side then an ISO view is chosen.
- Color Coding
  - **Mesh – Element Thickness**

Add a new graphics chapter for code check results:

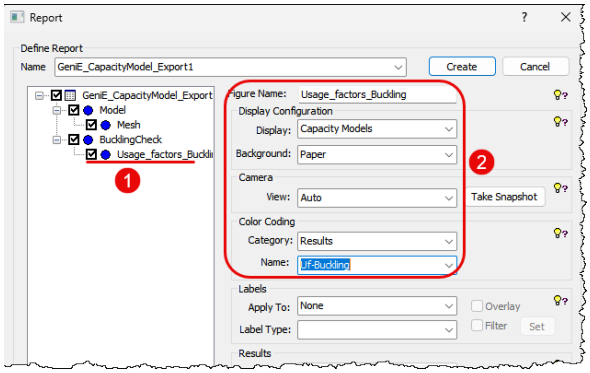




- Select top level **GeiE_CapacityModel** in tree view and add another **Grahpics** chapter
- Rename the chapter name to **Buckling check**
- Check **Loop Sets** and select 3-5 **different sets** in Structure selection.
- Check **Loop Loadcase**
  Set the following options for Analysis selection:
  - **Capacity Manager = Cc_Buckling**
  - **Runs = Cc_Buckling.run(1)**
- Check **Worst Loadcase**

Set options for plot of buckling yield usage factors:

- Rename Figure Name to **Usage_factors_Buckling**
- Display Configuration
  - **Display = Capacity Models**
- Color Coding
  - **Category = Results**
  - **Name = Uf-Buckling**
- Click Modify

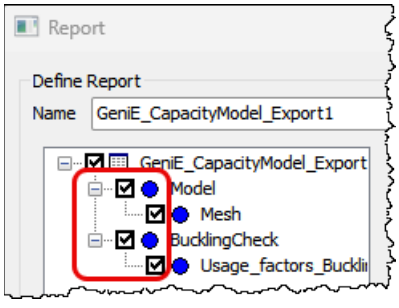


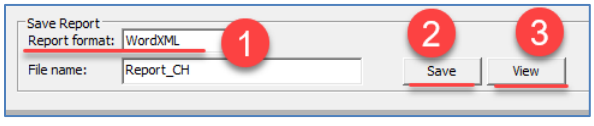
Creating this report will take some minutes. Since creating a report with many pictures takes a long time, it is useful to test the chapters separately (**check/uncheck chapters in the tree view**) first, before creating the full report.

Make sure that Report format is set to **WordXML** or **Html** and Click **Save** to create the report.

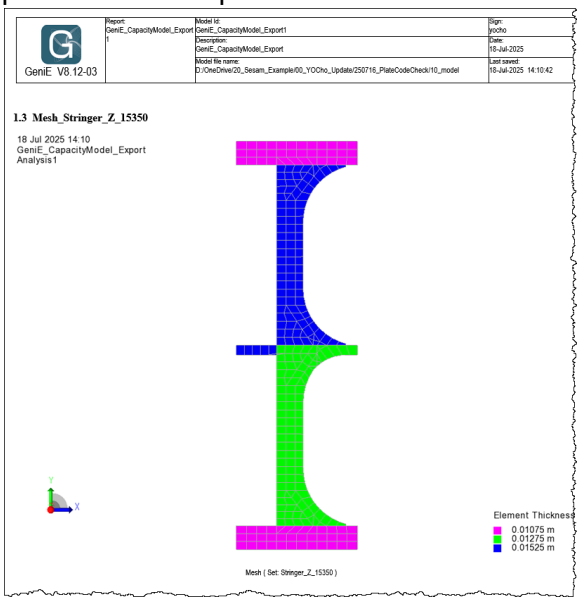
Click **View** to open the report after creation.

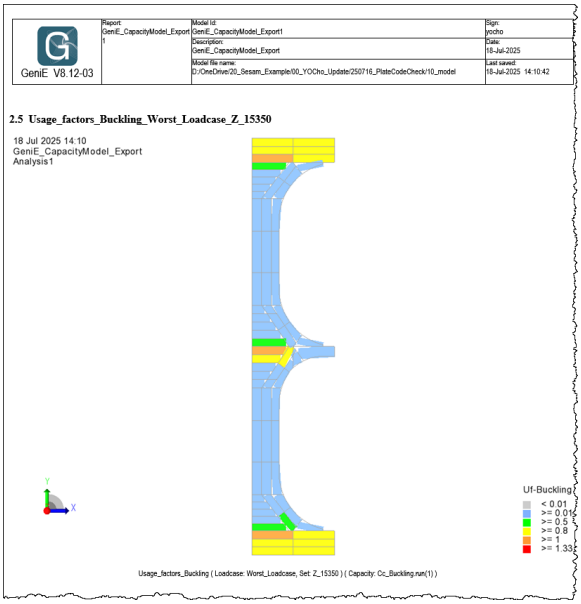
(If the word XML file is not opened from GeniE, then try to open from MS Word)

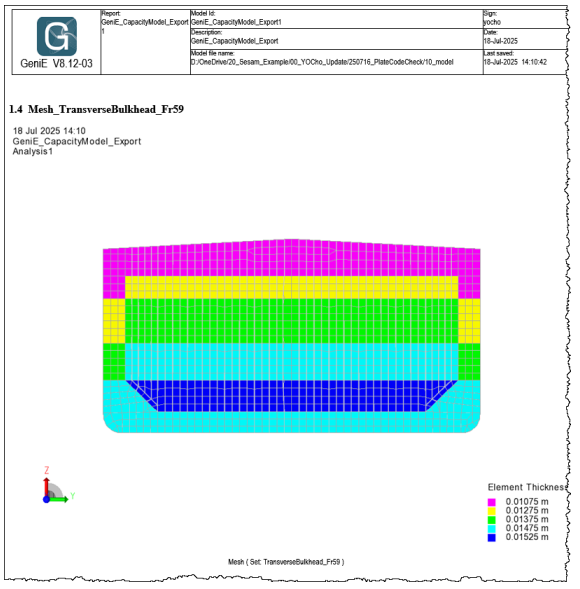


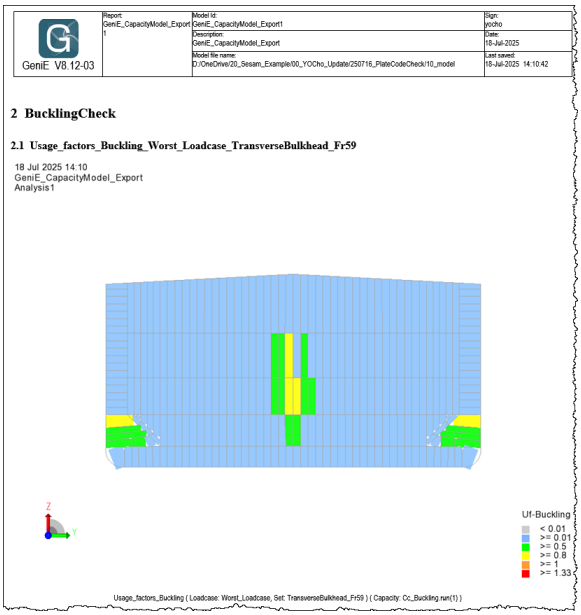


examples from final report:









4 REFERENCES

- DNVGL-CG-0127 Finite element analysis, Nov 2020
- DNVGL-RU-SHIP Pt.3 Hull, July 2025
- DNVGL-CG-0128 Buckling, Sep 2021

About DNV

We are the independent expert in risk management and quality assurance. Driven by our purpose, to safeguard life, property and the environment, we empower our customers and their stakeholders with facts and reliable insights so that critical decisions can be made with confidence. As a trusted voice for many of the world's most successful organizations, we use our knowledge to advance safety and performance, set industry benchmarks, and inspire and invent solutions to tackle global transformations.

Digital Solutions

DNV is a world-leading provider of digital solutions and software applications with focus on the energy, maritime and healthcare markets. Our solutions are used worldwide to manage risk and performance for wind turbines, electric grids, pipelines, processing plants, offshore structures, ships, and more. Supported by our domain knowledge and Veracity assurance platform, we enable companies to digitize and manage business critical activities in a sustainable, cost-efficient, safe and secure way.