

## New Features

### ProtaStructure Suite 2020 – What's New

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Please contact us for your training and technical support queries

[asiasupport@protasoftware.com](mailto:asiasupport@protasoftware.com)

[globalsupport@protasoftware.com](mailto:globalsupport@protasoftware.com)

Publisher



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# Introduction

At Prota we are fully committed to providing industry leading, accurate and highly practical structural BIM modeling, analysis, design, and detailing solutions to the consultancy and engineering industry.

ProtaStructure 2020 is a fantastic new release representing a major milestone in the evolution of our vision and commitment to you.

ProtaStructure 2020 takes advantage of the latest technology platforms and 64-bit processing and architecture.

It has been created to provide a more seamless, fluid and optimised experience.

We have carefully redesigned the User Interface from scratch to provide an enhanced user experience whilst preserving what you know and love about ProtaStructure. We have built on our unique open BIM platform which allows you to share, communicate and take advantage of the integrated workflows leading BIM technology provides.

We hope you enjoy the many new features, enhancements, and experiences that are awaiting you in ProtaStructure 2020.

Thank you for choosing ProtaStructure.

## Technology and the User Experience

### The 64-bit Architecture and Enhanced Technology Platform

At Prota we are continuously investing in the latest technologies to provide you with unique, fit for purpose structural engineering solutions. ProtaStructure 2020 is now fully compatible with 64 bit operating systems. We have further optimised this bringing enormous advantages to speed and model management. This means that you will be able to operate, analyse, design and detail any sized model faster than ever before.

With ProtaStructure 2020 we have re-engineered our existing technology to a new and more scalable platform, allowing us to provide you with more improvements, new features, and a fantastic user experience now and into the future.

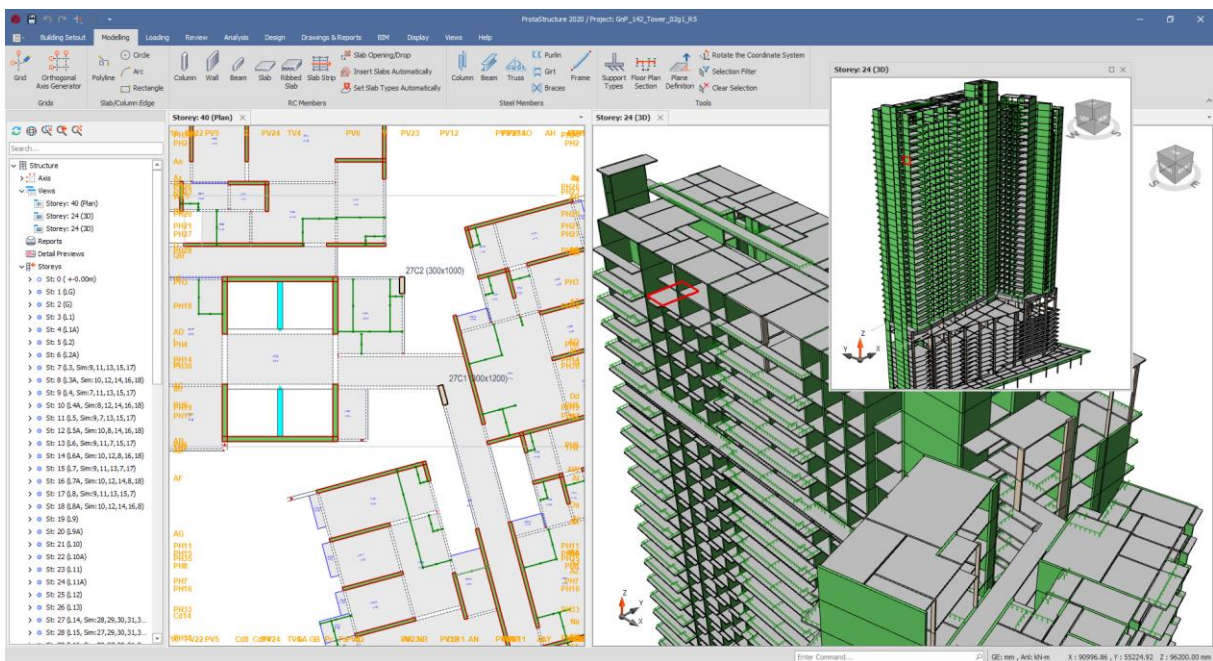
### A Modern Interface with Fluid User Experience

ProtaStructure 2020 welcomes you with a modern user interface designed from scratch for ease of use without compromising efficiency.

### Our New User Experience Interface - Everything is in its right place

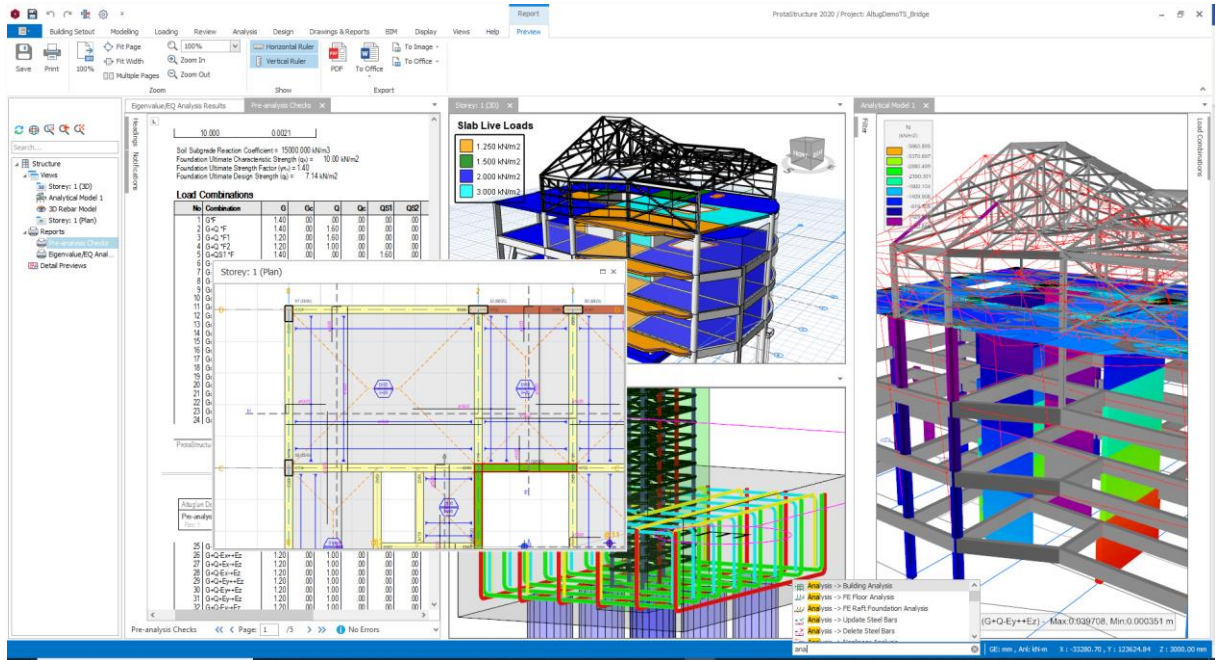
Check out our new fluid ribbon experience blending the familiar with the new. Logically laid out to guide you through the entire design process – from setout and modelling to seamless BIM collaboration.

Open as many views as you need, including analytical models, reports, 3D rebars, and modeling views. Views can be organized using smart layout options.



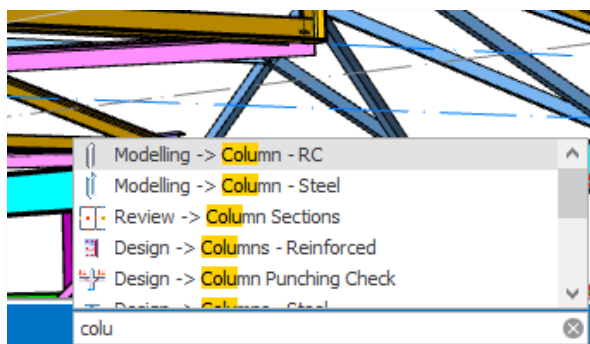
## Detach, Dock or Float the Windows

Customize your work area by docking and floating views. We also considered engineers using multiple monitors. If you want to make the most of your screenscape, just move one of the views to another screen.



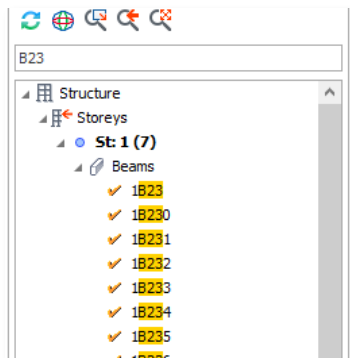
## Command Search

Type into new 'Command Search' function to access mostly used functions just in seconds. The smart search bar will list the available commands for the current context.



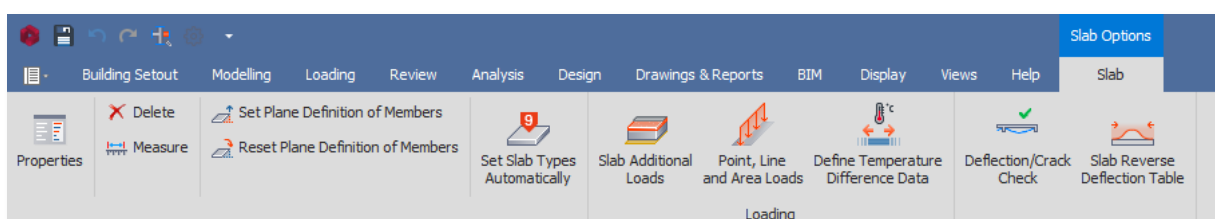
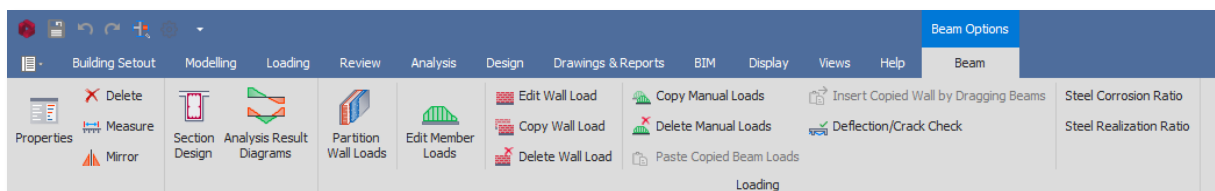
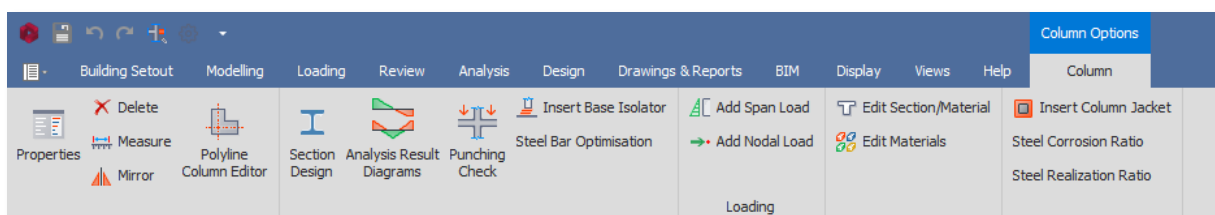
## Search the Structure Tree

Looking for a specific member? Type in the member label in the structure tree's search box and let ProtaStructure find it for you.



## Contextual Ribbon Tabs

Commands and functions specific to a member type or group of members are now directly accessible in the New Contextual Tabs in addition to the right click menu. As soon as you select a member, relevant commands will appear in dedicated contextual ribbon tabs.

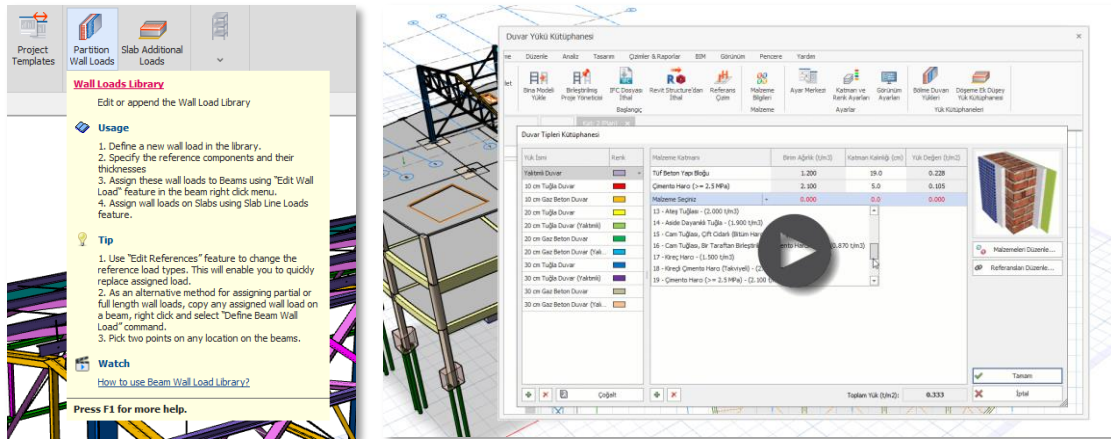


## Faster Learning Curve: In-Product Learning and Help

We value the time you invest in learning all of what's possible with ProtaStructure. To get most out of ProtaStructure 2020, we are proud to introduce our new in-product learning tools. You will be onboard in no time with this fabulous new interactive help, perfect for both those new to Prota or those wanting to extend their knowledge.

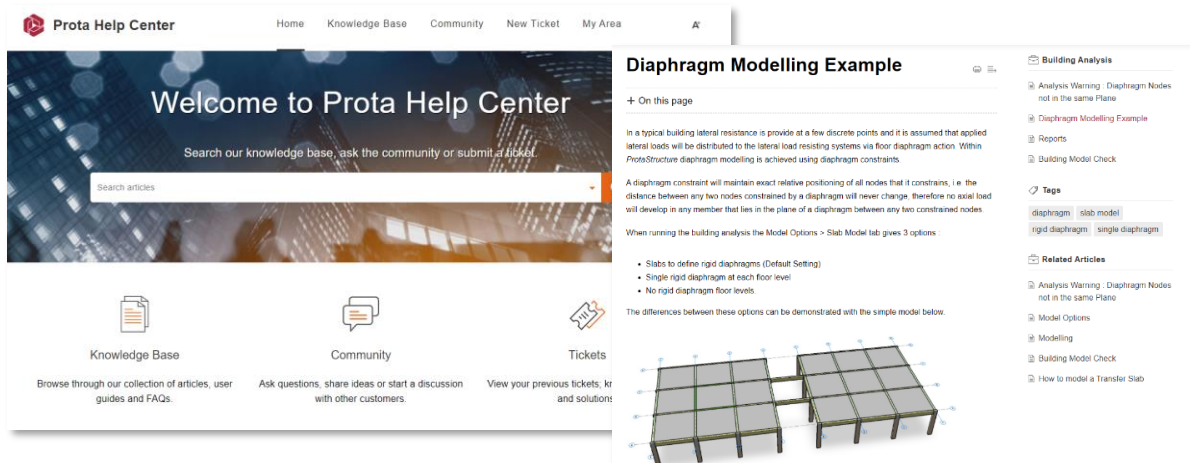
### Detailed tooltips with Video Tutorials

Hover over any button and our interactive tooltip appears with useful **Descriptions, How To, Tips, and Short Animations/Videos** to guide to seamlessly through the features of ProtaStructure.



### Contextual links to Prota Help Center

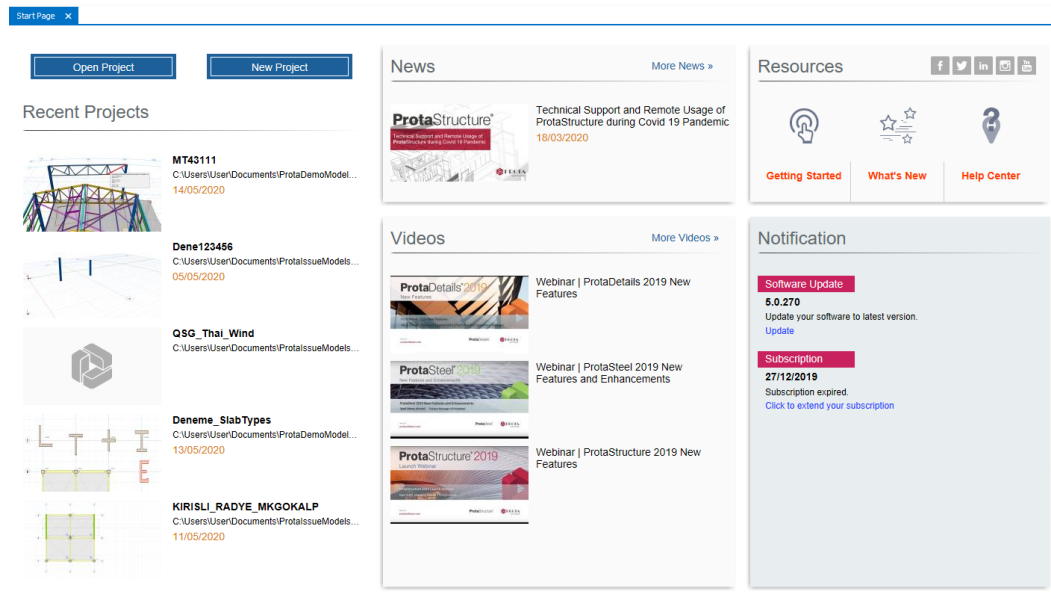
Get instant, relevant information with a key stroke. Whenever you hit F1 on a tooltip or window, you will be taken directly to **relevant knowledge base article** in our Prota Help Center, providing direct information on what's important to you.





## Prota's Welcome Screen: The One-Stop-Shop for Training Resources, News and Notifications

Launching ProtaStructure brings you instantly up-to-date with Prota's world. Access the latest news, software updates and learning resources all from our new all-in-one **welcome screen** dashboard.

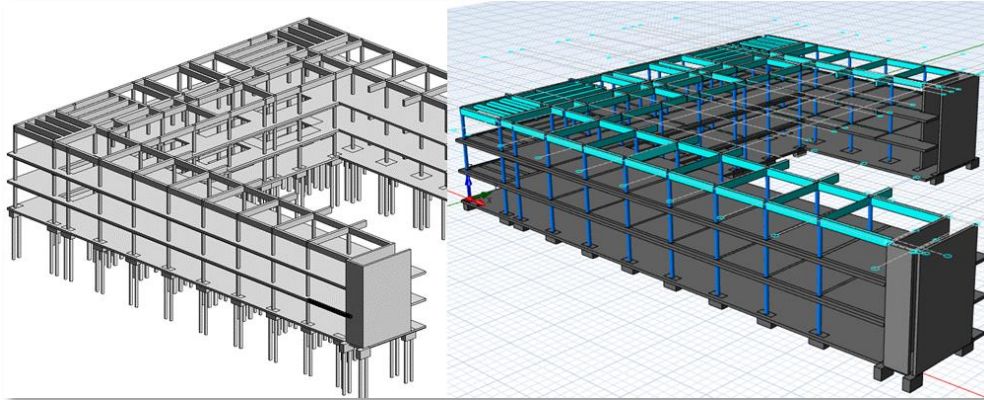


### Instantly Get Updates with the New Update Delivery Technology

Our new update system notifies you about any software updates instantly. Required files will be replaced without the need to install the software.

## Leading BIM Integration – Powered by ProtaHUB

We understand that you don't always have all the information in the BIM-Rich format you require. So we have developed ProtaHUB, a unique common BIM platform underlying ProtaStructure. This allows us to understand IFC and other common model data definitions (such as 2D and 3D DXF), even if they only have only Solid or Face representations, and seamlessly convert these to intelligent structural models you can use in ProtaStructure.

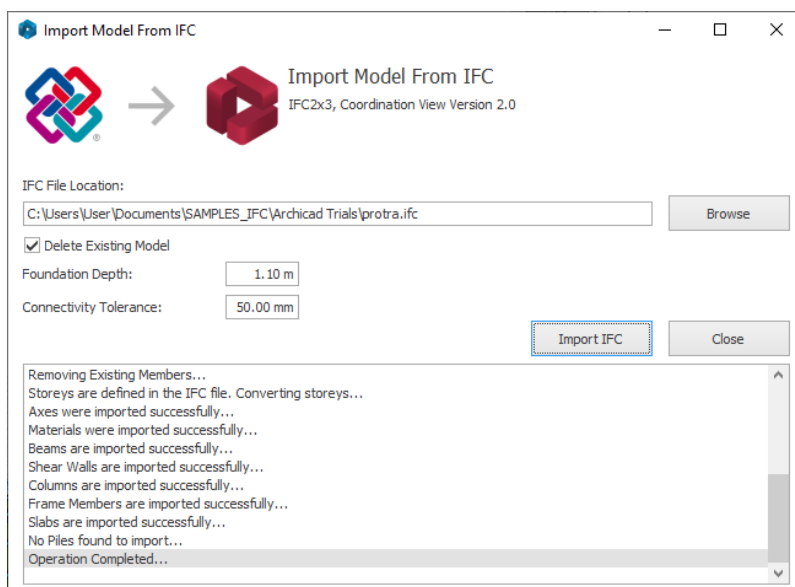


### Import IFC Files from a Wide Range of Sources

Prota continues to deliver industry leading BIM Integration. ProtaStructure can now receive models from a wide range of IFC sources (like architectural or other structural software).

The biggest hurdle that stands in the way of effective BIM Integration today is the different implementations and interpretations of data among the existing software.

ProtaStructure 2020 makes this easy with our unique ProtaHUB allowing you to import IFC 2x3 Coordination View data directly into ProtaStructure to create your models.

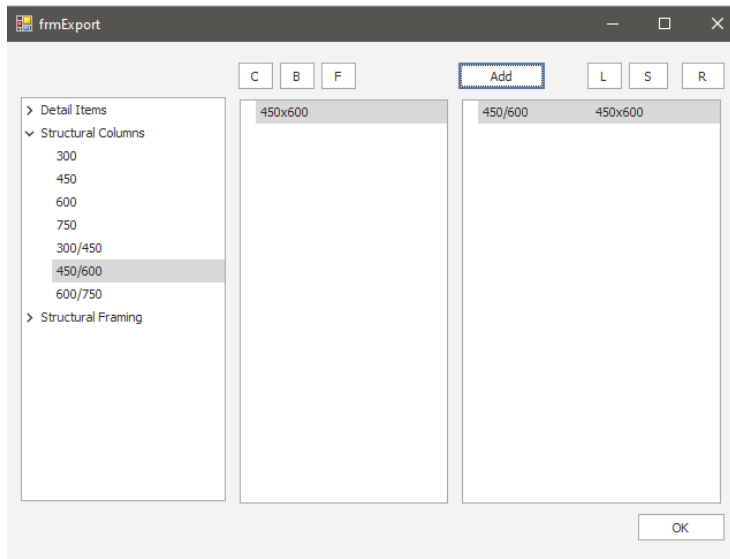




## Revit Family Mapping

When it comes to BIM, every company has its own unique way of working. From file naming conventions, parameter names, folder structures, to unique family designations and shared parameters, we recognise that each designer needs a flexible approach to creating and sharing project information.

With our dedicated Revit Add-on, you can use any Revit template to start communicating with ProtaStructure. We have developed a new family mapping tool that enables you to use your own families to match your workflow.

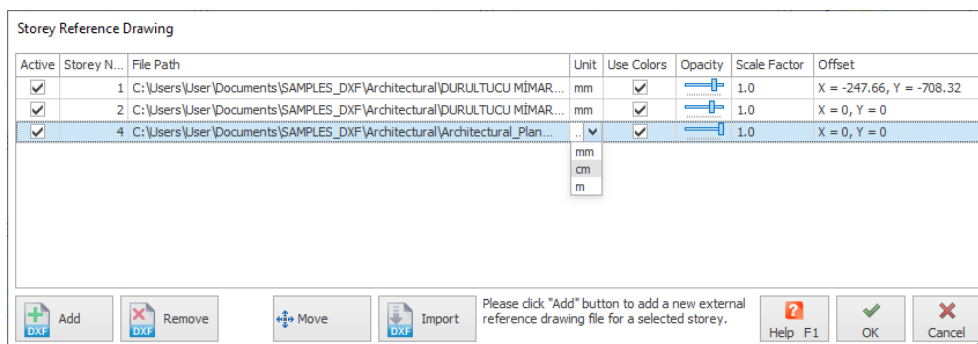


## Import from 2D DXF Files - External Reference Drawings

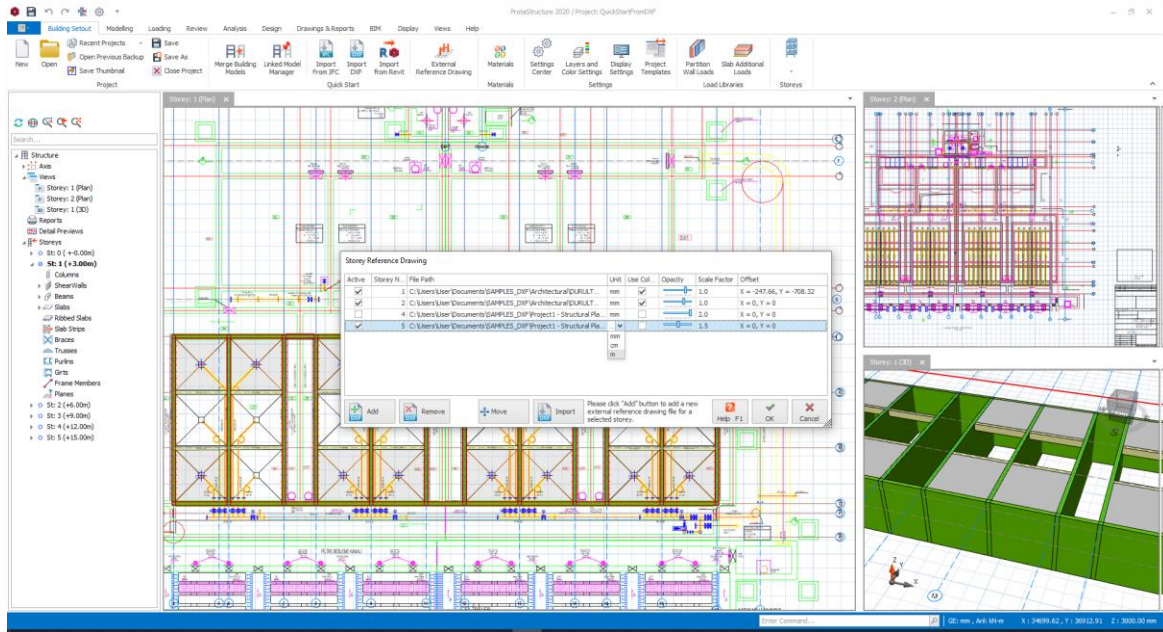
ProtaHUB now allows you to take full advantage of any existing 2D drawing information, like structural and architectural key plans, to rapidly setup and co-ordinate your models.

### Have Architectural or Service Plans?

We've enhanced further our reference drawing import module. You can assign different DXF drawings for each storey. Manage them all in a single neat environment. Have full control over how the drawings are positioned. Change any property like opacity, scale factor, color-scheme, even the import unit and assigned storey any time you want.

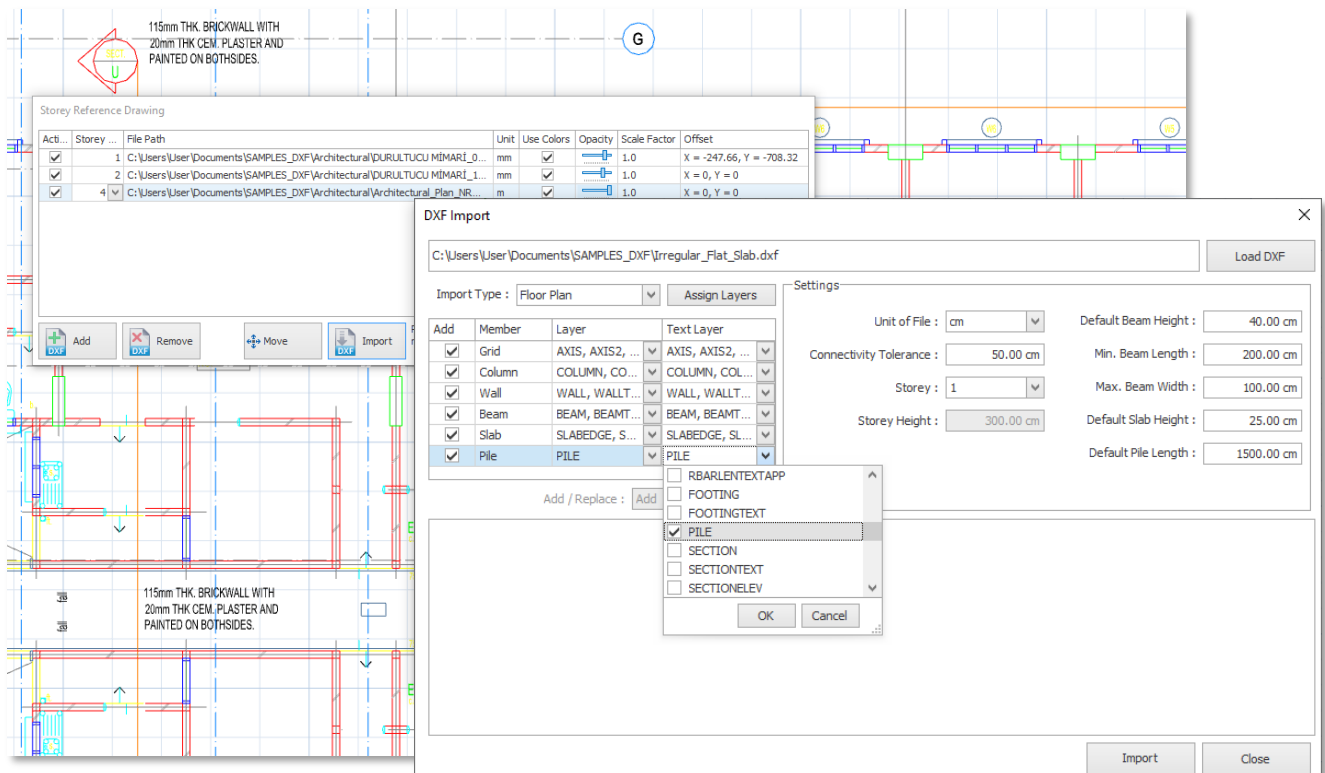


Hide and show reference drawings as you need. Find them the way you left next time you open your project.



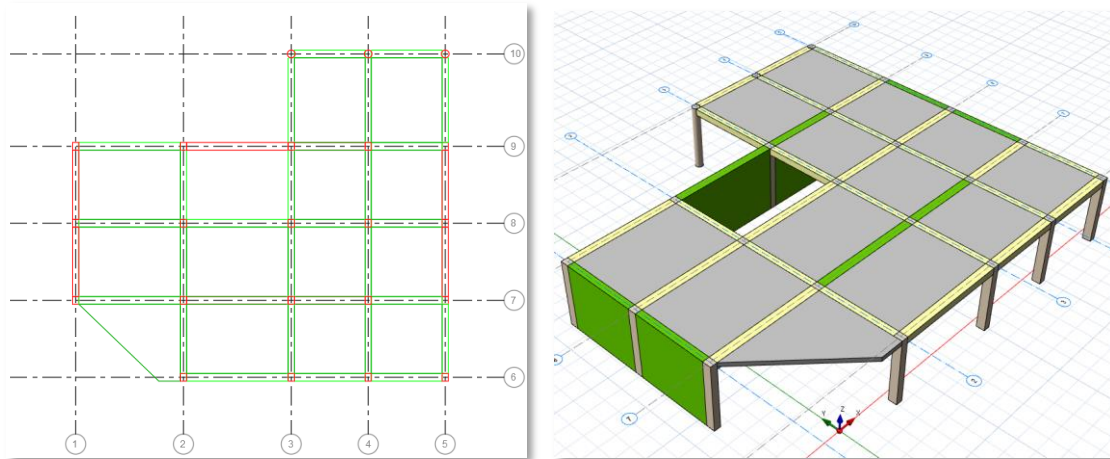
## Have Structural Key Plans in CAD?

Why stop there? Select a reference drawing and import elements to jump start your structural model.



Take advantage of ProtaStructure's new 2D DXF import where we'll extrude and create 3D information directly from your 2D drawings. Create gridlines, columns, walls, beams and slabs instantly and intuitively; greatly enhancing modelling times.

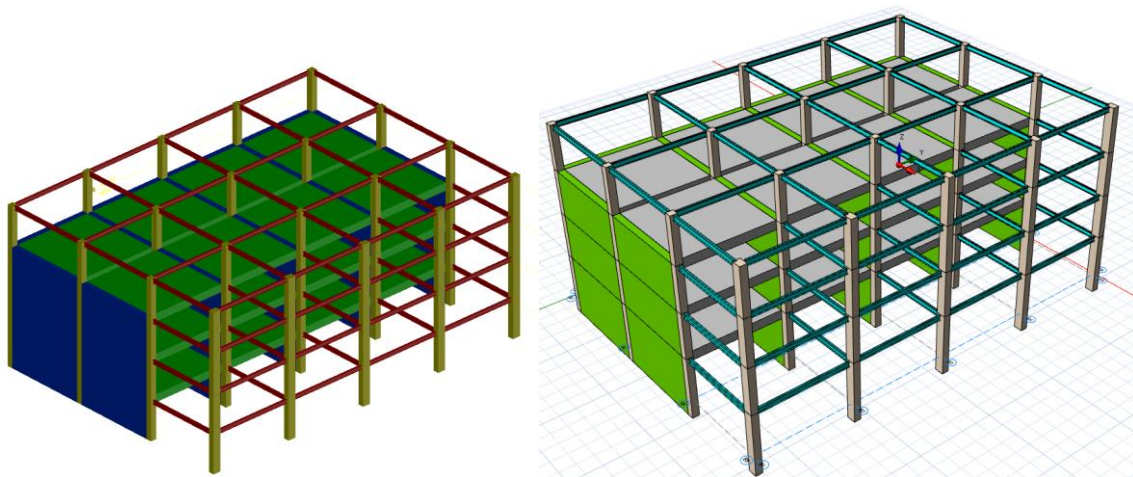
All layers are examined for keywords and relevant layers are automatically assigned to member types immediately upon loading of a DXF file. Entities assigned to multiple layers can be imported at once



2D DXF > ProtaStructure

## Import from 3D DXF Files

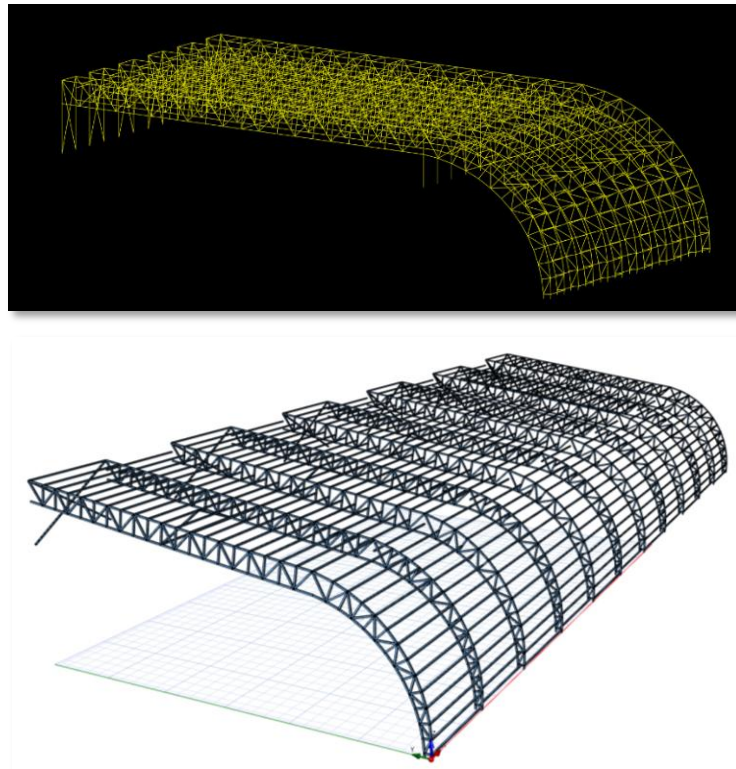
Not all software comes with high-level BIM collaboration skills like IFC and a Bespoke Native Revit Link as ProtaStructure does. Some of them are just bound to low-level data export facilities like 3D DXF. This won't stop you communicating with them anymore. ProtaStructure's 3D DXF import feature can make sense of 3D objects such as polyface meshes, solids, 3D solids, blocks and more.



3D DXF > ProtaStructure

ProtaStructure generates sections, figures eccentricities and even creates grids when necessary to build a physical structural model automatically. Storeys are assigned intelligently by querying all the member positions.

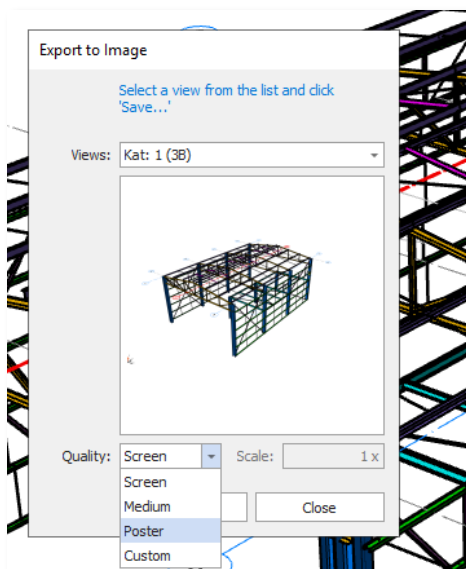
You can even import analytical 3D models made of lines and meshes. ProtaStructure assigns default section material properties. No grid definition is required.



*Analytical Model defined in DXF File > ProtaStructure*

## Poster Quality Image Export

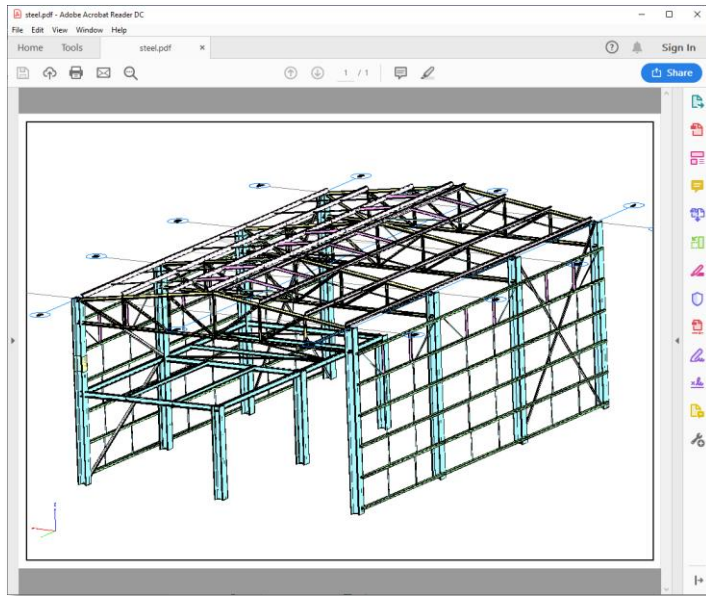
You can now create poster-quality images out of your model. Model vectors are scaled up before rasterizing and you get a crisp and high resolution image to be used in printed media, presentations, reports or web sites.





## 3D PDF Export

PDF readers on the market are able to interpret 3D information and visualize it. That allows you create better presentation materials and a means to share your model view with your colleagues even on mobile devices. ProtaStructure can help you to achieve this by exporting the structure's 3D geometry information to 3D PDF format.



## Extended Code Coverage

### New Codes of Practice

Following new codes of practice are supported and the support for existing ones are enhanced in ProtaStructure 2020:

- Thailand Seismic Code (DPT 1301/1302-61)
- Thailand Wind Code (DPT 1311-50)
- Indonesia Seismic Code SNI1726-2019
- Eurocode 2 and Eurocode 3 Poland National Annex

Code	Country	Description
TS 648	Turkey	Çelik Yapıların Hesap ve Yapım Kuralları (1980)
Eurocode 3	EU	(EN 1993) Design of Steel Structures (Base Code)
Eurocode 3 (SG)	EU	(EN 1993) Design of Steel Structures (Singapore Annex)
Eurocode 3 (MY)	EU	(EN 1993) Design of Steel Structures (Malaysia Annex)
Eurocode 3 (UK)	EU	(EN 1993) Design of Steel Structures (UK Annex)
Eurocode 3 (PL)	Poland	(EN 1993) Design of Steel Structures (Poland Annex)
BS 5950	UK	Structural Use of Steelwork in Building
AISC 360-10 (LRFD)	USA	Specification for Structural Steel Buildings (LRFD)
AISC 360-10 (ASD)	USA	Specification for Structural Steel Buildings (ASD)
TSC 2016 (LRFD)	Turkey	Çelik Yapıların Tasarım, Hesap ve Yapım Esasları (YDKT)
TSC 2016 (ASD)	Turkey	Çelik Yapıların Tasarım, Hesap ve Yapım Esasları (GKT)

Code	Country	Description
TDY 2007	Turkey	Deprem Bölgelerinde Yapılacak Binalar Hakkında Yönetmelik
TBDY 2018	Turkey	Türkiye Bina Deprem Yönetmeliği
SNI1726 2012	Indonesia	Procedures for Earthquake-Resistant Design of Structures
NSCP 2015	Philippines	National Structural Code of Philippines 2015
Eurocode 8	EU	(EN 1998) Design of Structures for Earthquake Resistance (Base Code)
Eurocode 8 (SG)	EU	(EN 1998) Design of Structures for Earthquake Resistance (Singapore Annex)
Eurocode 8 (My)	EU	(EN 1998) Design of Structures for Earthquake Resistance (Malaysia Annex)
IBC	USA	International Building Code
UBC	USA	Uniform Building Code - 1997
DPT 1302-61	Thailand	Seismic Loading Standard for Building Design in Thailand

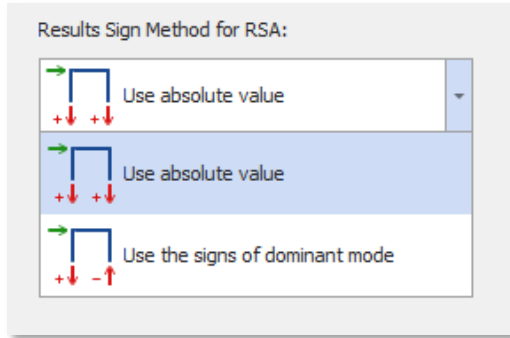
Code	Country	Description
BS8110-1997	UK	Structural Use of Concrete (1997)
CP65	Singapore	Structural Use of Concrete
HK-2004	Hong Kong	Structural Use of Concrete (2004)
TS500-2000	Turkey	Betonarme Yapıların Tasarım ve Yapım Kuralları (2000)
Eurocode 2	EU	(EN 1992) Design of Concrete Structures (Base Code)
Eurocode 2 (UK)	UK	(EN 1992) Design of Concrete Structures (UK Annex)
Eurocode 2 (IR)	Ireland	(EN 1992) Design of Concrete Structures (Ireland Draft Annex)
Eurocode 2 (SG)	Singapore	(EN 1992) Design of Concrete Structures (Singapore Annex)
Eurocode 2 (MY)	Malaysia	(EN 1992) Design of Concrete Structures (Malaysia Draft Annex)
Eurocode 2 (HK)	Hong Kong	(EN 1992) Design of Concrete Structures (Hong Kong Annex)
Eurocode 2 (PL)	Poland	(EN 1992) Design of Concrete Structures (Poland Annex)

### RSA Results Sign Method

Response Spectrum Analysis calculates and combines the pseudo maximum responses of natural vibration modes against a given design spectrum by assuming each mode as an independent single degree of freedom system. During the combination of modal result vectors, the sign of the displacements and internal forces are lost and hence equilibrium condition is not satisfied anymore. If you check the deflected shape of the structure under response spectrum load cases, you may see weird displaced shapes due to this fact. Also, internal force diagrams will always be positive after the combination. This is the expected behavior and natural output of response spectrum analysis.

Most of the time, this is easily overcome during the design by combining RSA load cases with dead and live load cases using both negative and positive coefficients. However, for deflection checks and other structural checks, you may need the signs of the internal forces and deflections.

For this purpose, ProtaStructure hosts a setting to either use the '**Absolute Values**' or '**Sign of Dominant Mode**' for RSA result signage.

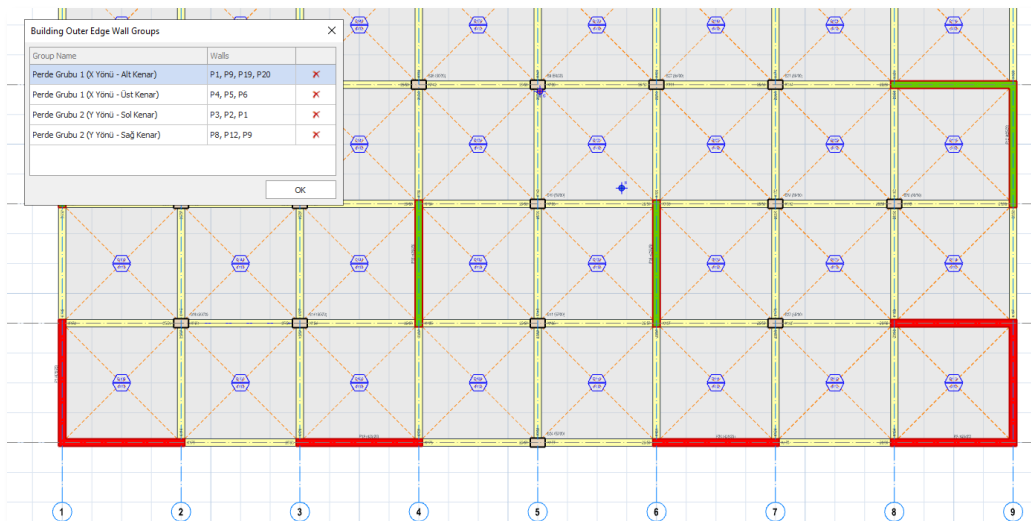


If dominant mode signs are used for overall RSA results, then the dominant mode will be selected depending on its mass participation in a certain DOF, and the sign of that mode will be used for the particular RSA load case in the relevant direction. This approach may yield unexpected results in highly irregular structures where the dominant mode is a torsional mode or translational mode with high coupling.

## Edge Walls Bending Contribution Checks

To assess structural system load distribution within the lateral load resisting system, you may want to mainly review the moments or shear forces carried by edge wall groups to the overall overturning moment or base shear.

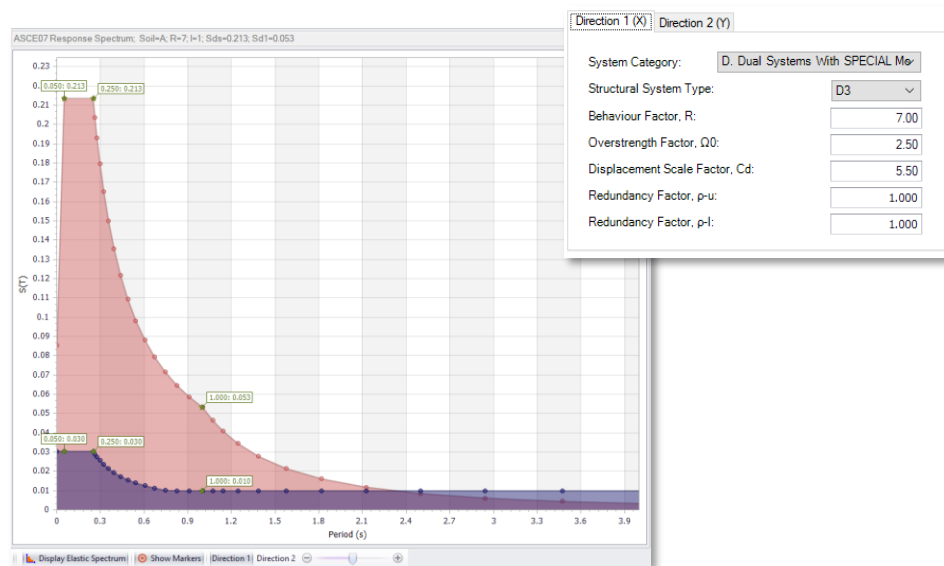
The new wall grouping functionality in ProtaStructure allows you to create groups of walls and assess the base shear and moments carried by them against the structural output.



## Usage of Different R values for Each Orthogonal Direction

This feature was originally introduced in ProtaStructure 2019 but further enhanced in 2020.

Users can now define different structural system types (different R behavior and overstrength factors) for two different orthogonal directions.





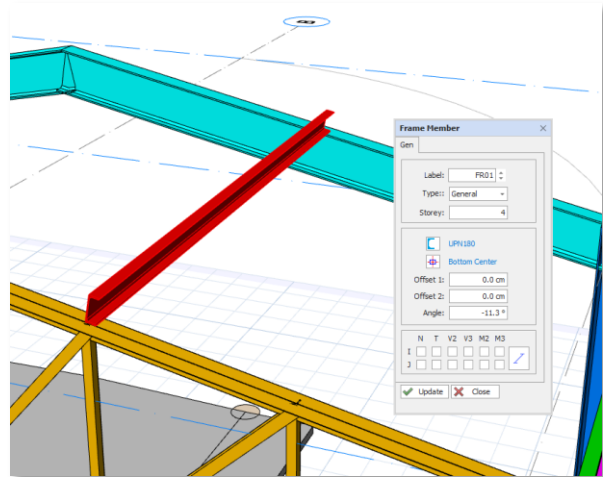
## Modelling

### Our New Flexible Frame Member

ProtaStructure supports practical tools for quick insertion of steel members such as purlins, girts, trusses, braces, sag-rods, and so on.

To provide even more flexibility for you to model steel structures, we have introduced the free **"Frame Member"** that you can insert anywhere in the model.

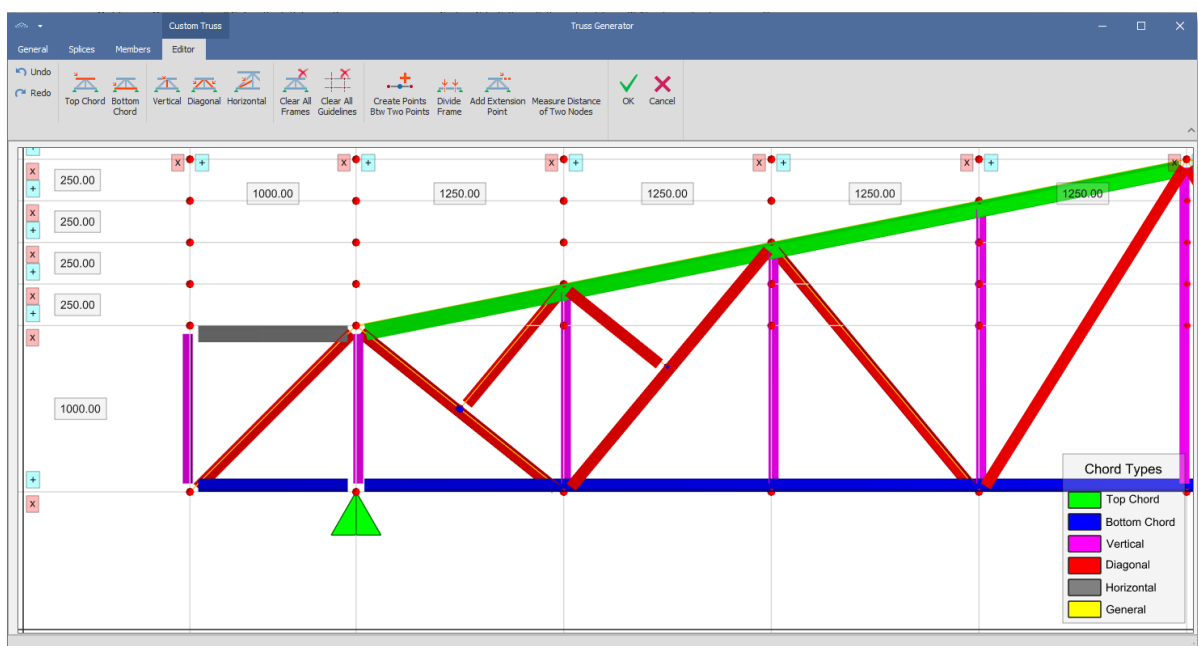
Frame member sections can be rotated in any orientation, and local offsets can be assigned without compromising the analytical model. You can assign end releases in the direction of any degrees of freedom.



### Custom Truss Editor

ProtaStructure provides an extensive library of parametric truss members. You can easily select truss type and pattern, set the parameters and insert the truss.

To provide you with even more flexibility we have introduced a brand-new **Custom Truss Editor** to create custom trusses of any shape.

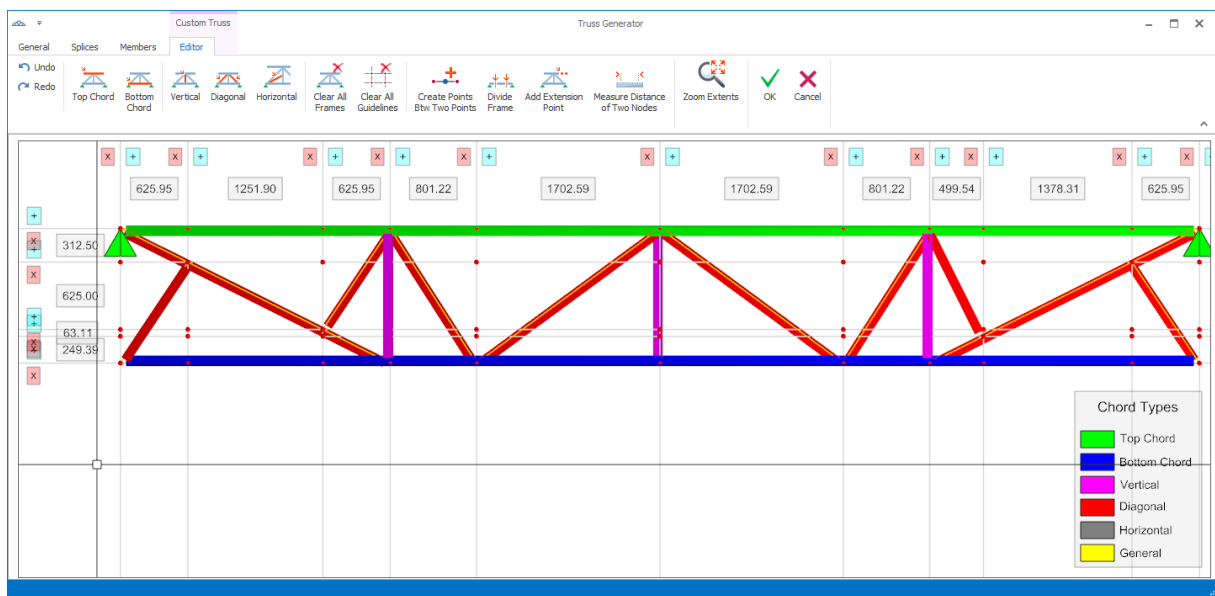
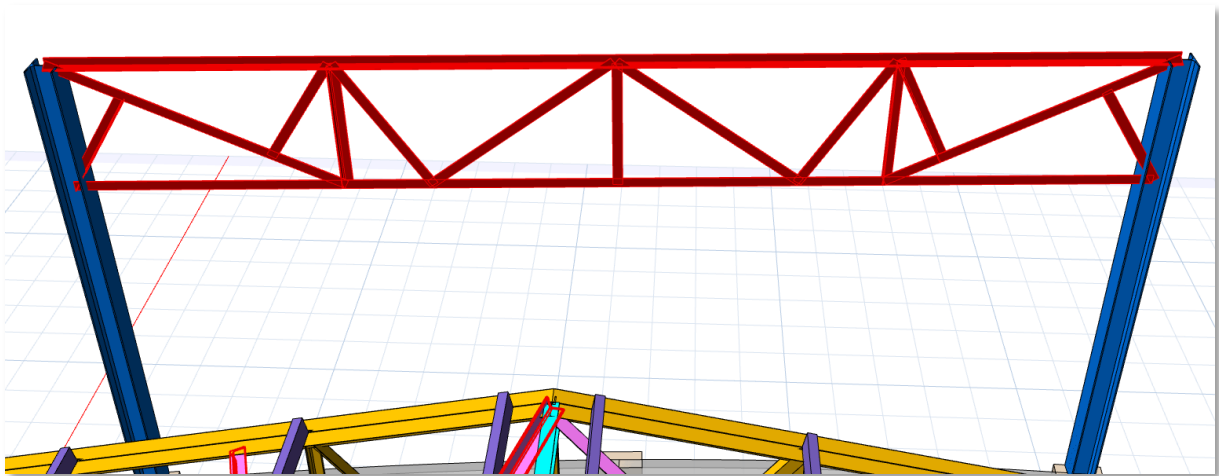
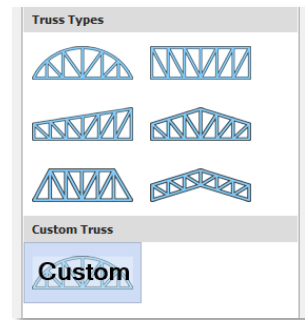


## Convert Any Parametric Truss to a Custom Truss

You can also start with any parametric truss in the library and customize it to your needs. As you develop this, you can return back to the parametric truss library and come back to your custom design as needed. Your draft is cached for you, in case you change your mind.

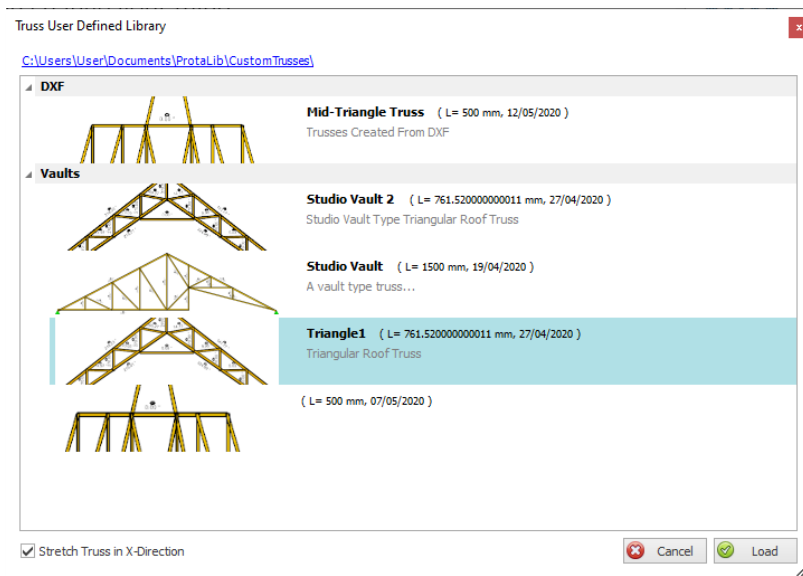
## Convert Free Frame Members into Trusses

Create any free geometry in 3D modelling environment using free frame members. Then select and convert them into a single truss element.



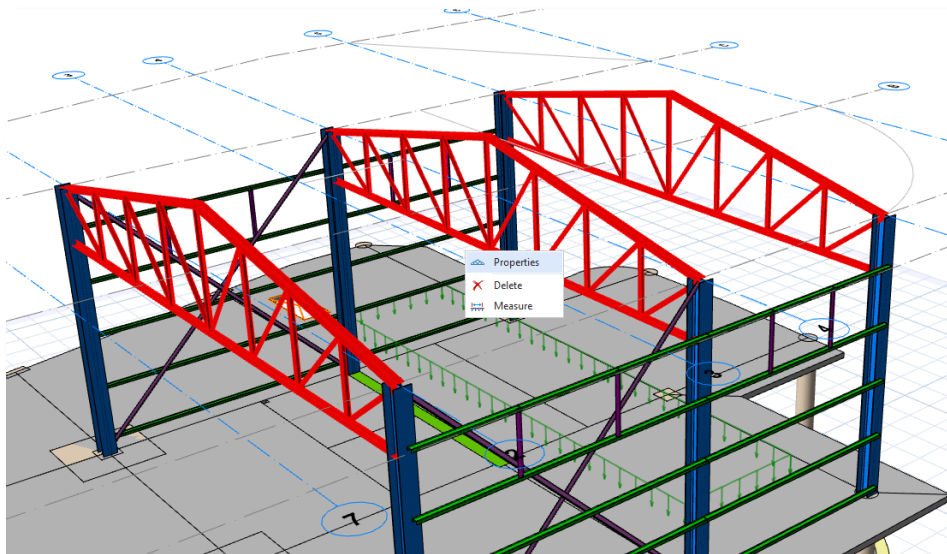
## Save Your Trusses to the Library and Share

Save any custom truss to the library where you can use it in other projects or simply share it with your colleagues.



## Edit Multiple Trusses

ProtaStructure 2020 allows you to edit multiple trusses at once. Selected trusses must be of the same type. This is an extremely efficient tool in case you need to change your design decisions after you have progressed in your model.



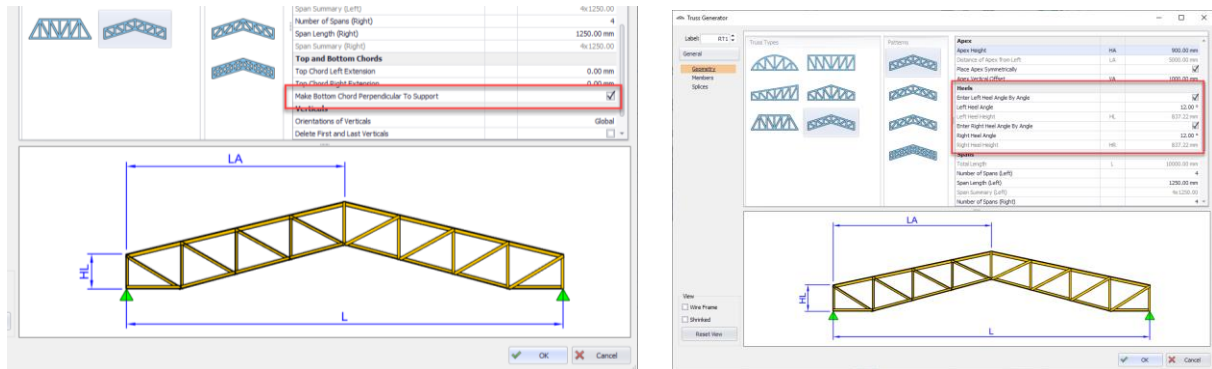
## Steel Trusses: New Features and Improvements

### Bottom Chords Perpendicular to Supports

A new option is added for trusses with sloping bottom chords. “**Make Bottom Chord Perpendicular to Support**” option can be preferred for ease of constructability.

## Slope Angle for Top Chords

In addition to Left Heel, Right Heel, and Apex Height, top chord inclination can also be defined with Slope Angles. For example, if the roof slope is known as a percentage, say **A%**, the angle can be calculated by the formula  $\arctan(A/100)$ . After Apex Height is specified, Left and Right Heel heights are automatically calculated using the given angle. Activate “**Enter Left Heel by Angle**” or “**Enter Right Heel by Angle**” options to use this feature.

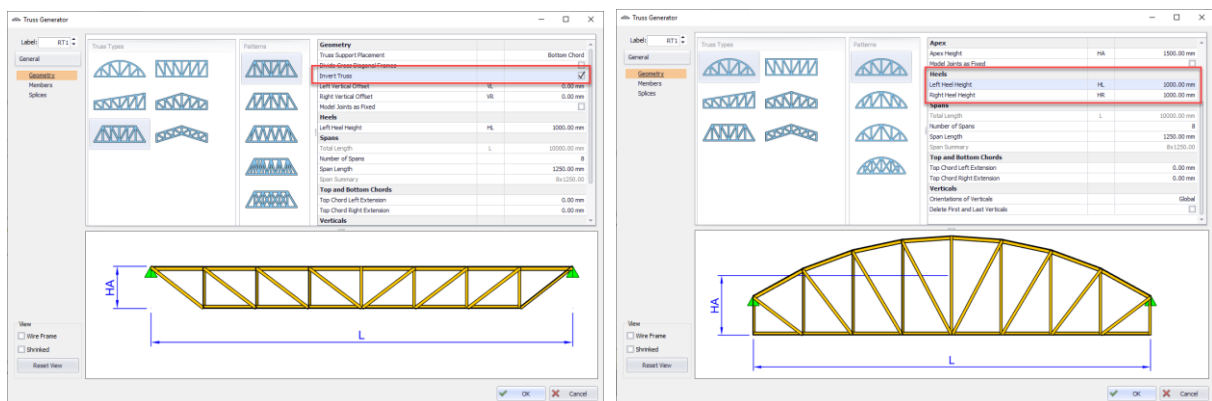


## Inverted Truss Types

All truss types now support an “**Invert Truss**” option.

## Specifying Heel Height for Curved Trusses

**Left** and **Right Heel Height** can now be specified for curved trusses.

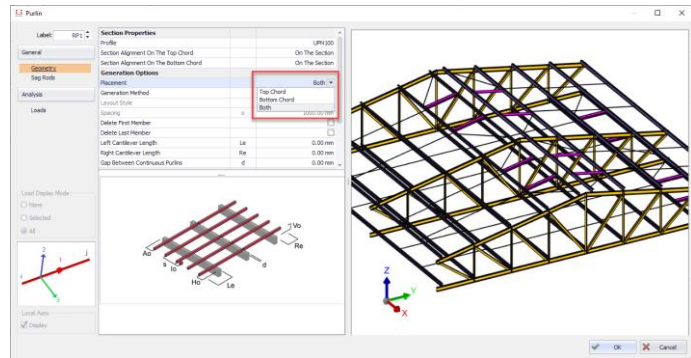
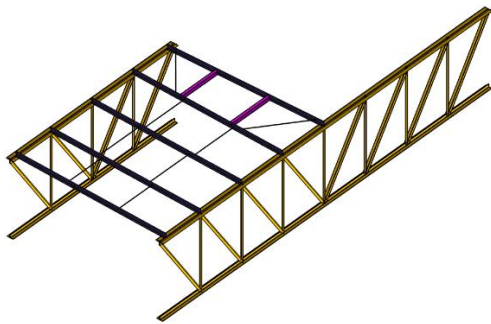


## Trusses with Different Number of Joints and Spans

Purlins can now be inserted on trusses with different spans and number of joints. The shorter truss governs the purlin layout.

## Inserting Purlins on Bottom Chords

A new option now allows purlins to be inserted on truss bottom chords.

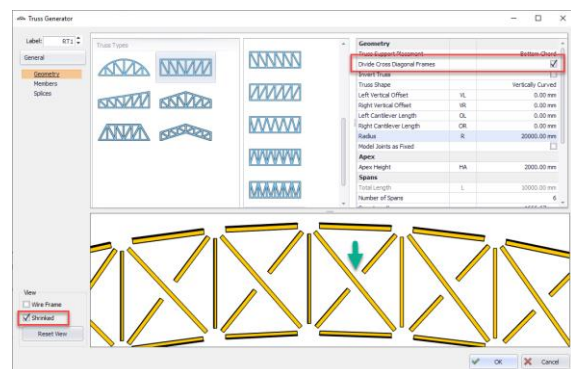
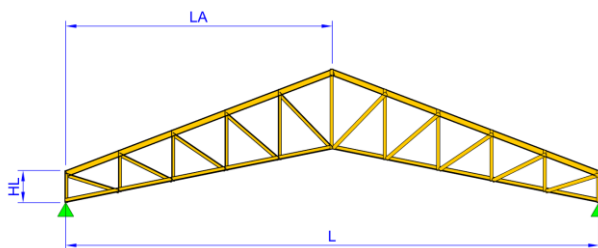


## A New Truss Type

A frequently used “Scissors” type truss with different Left Heel, Right Heel, and Apex Height can now be inserted.

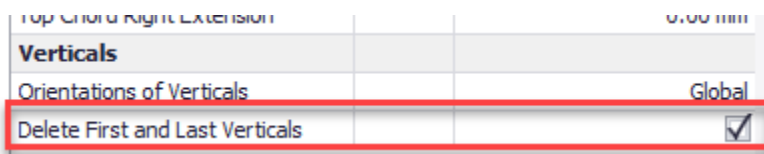
## Divide Cross-Diagonal Members

To quickly insert gusset plate connections on cross-diagonal members, we have introduced the “**Divide Cross-Diagonal Frames**” option.



## Delete First and Last Verticals

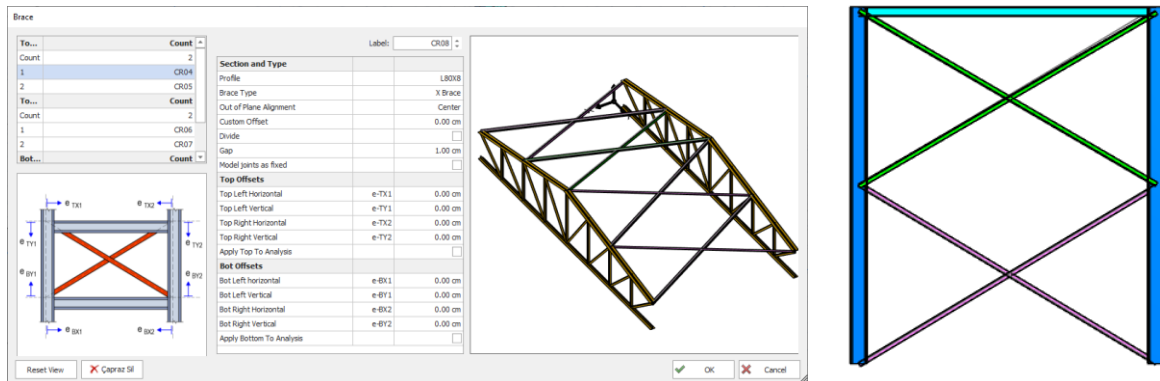
The deletion of first and last verticals is now an option rather than an automated operation. If this option is checked, the first and last vertical members are never generated in case of any parameter change. Additionally, if truss placement is set to “Top Chord,” then first and last verticals are automatically deleted for convenience.



## Insert Multiple Braces In One Go

Horizontal, inclined, or vertical braces with correct offsets, correct rotation, and orientation can be tricky and time-consuming to insert. Our new brace tool allows you to insert multiple braces with a few clicks to truss top and bottom chords, beams, and columns.

In the editor, you can select and change multiple brace properties at once. Moreover, you can delete or reposition individual brace offsets to further customize your brace pattern design.

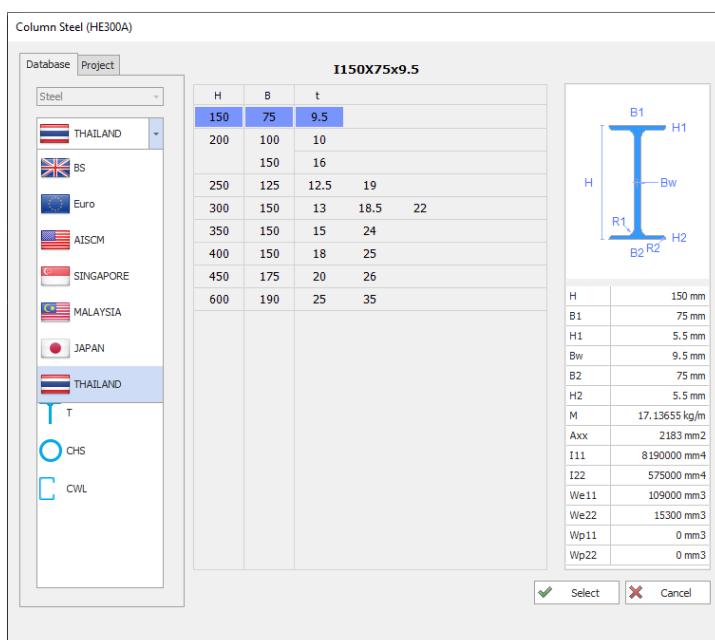


## Braces Between Truss Top and Bottom Chords

With ProtaStructure 2020, you can insert braces between truss top chords and bottom chords. Previous versions of ProtaStructure was only supporting brace insertion between columns and beams.

## Extended Steel Profile Library: Thailand and Philippines Profiles

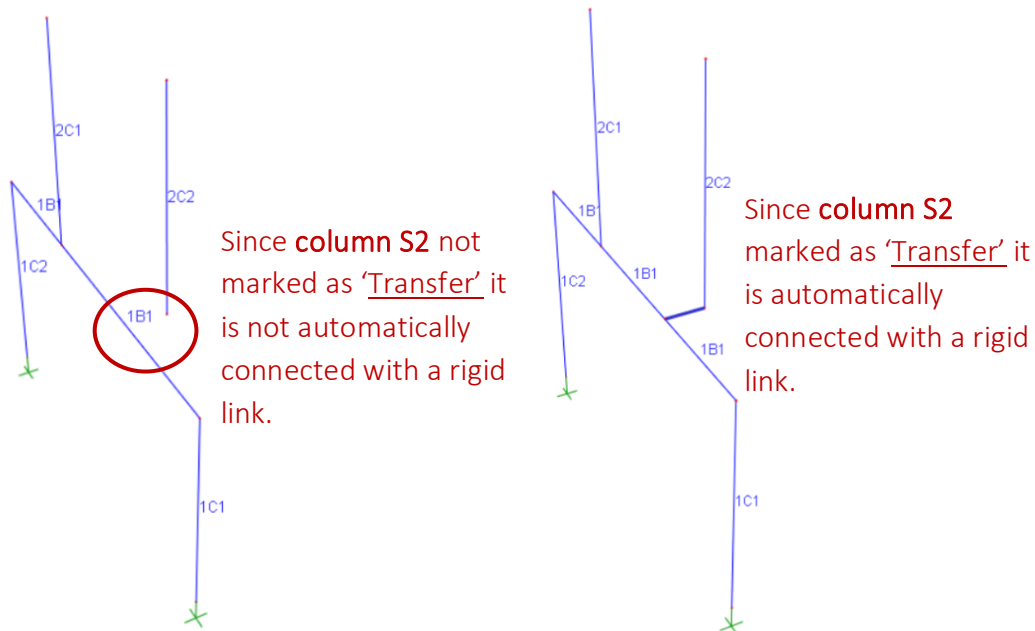
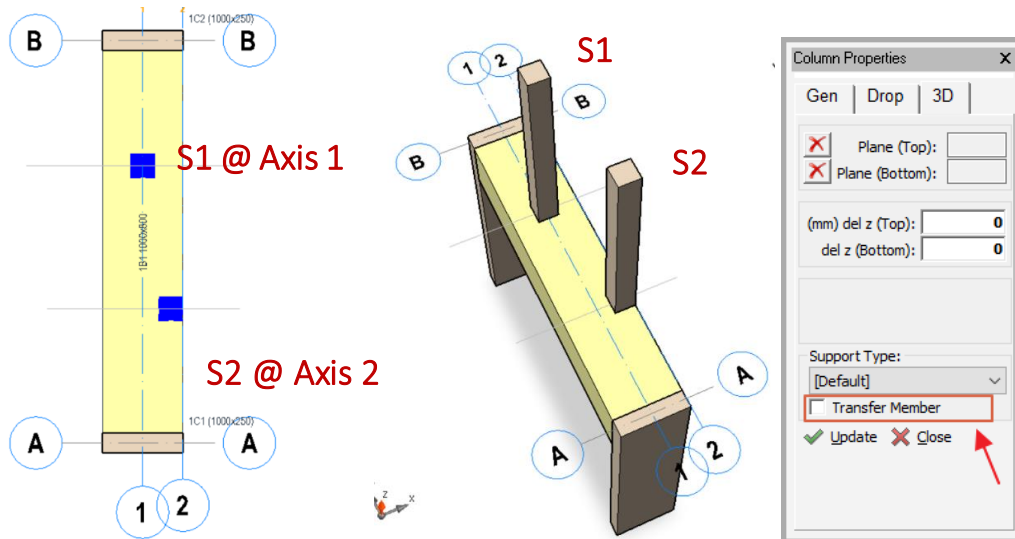
Commonly used Thailand profiles of RHS, SHS, CHS, I, H, C, T and CWL extends our ever growing profile database.



## Transfer Columns and Walls with Rigid Links

This feature was originally introduced in ProtaStructure 2019 but further enhanced in 2020.

You can now mark walls and columns as “Transfer”. Once marked this way, there won’t be any discontinuity message issued during the analysis. Additionally, if transfer columns are inserted on different gridlines, ProtaStructure will create rigid links automatically. Additionally, the design of beams supporting these transfer members is improved.

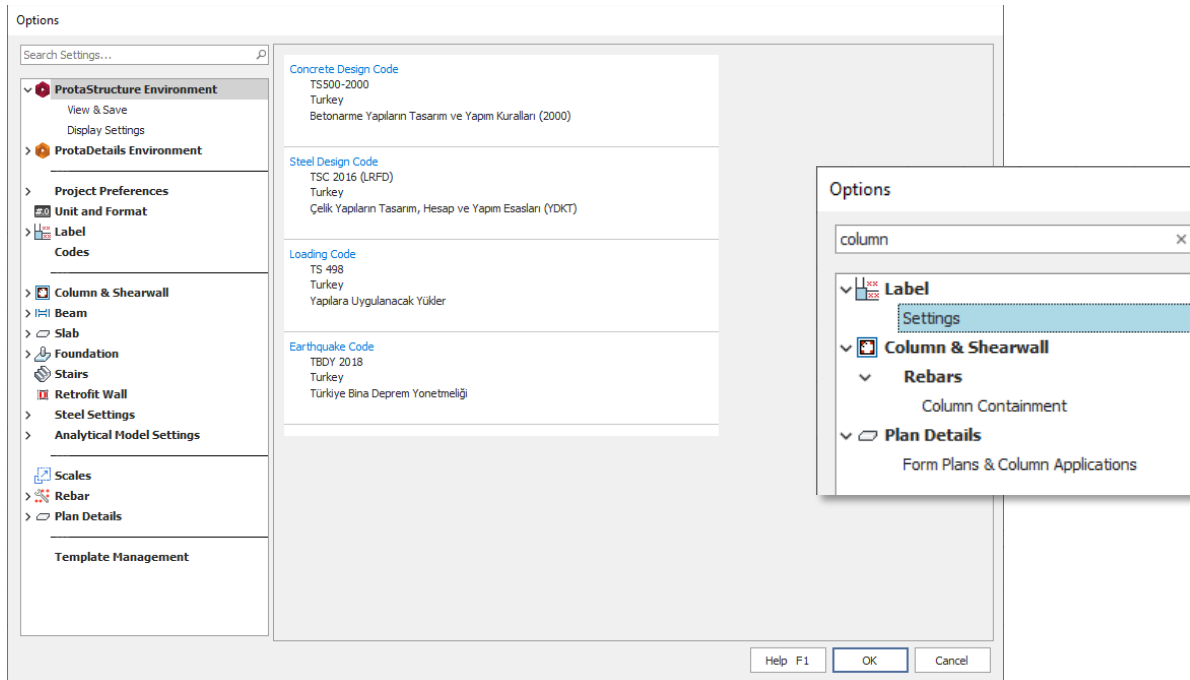




## The New Settings Center

### All project and system settings under one UI

Creating simple seamless user experiences is at the core of ProtaStructure 2020. We have now categorized and collected all settings and parameters under a single unified **'Settings Center'** that will enable you to tweak and fine-tune your design decisions easily.



### Search to access desired settings

You can perform keyword searches to find the parameter you need. It can be as simple as Concrete Cover, Column, Splice, Foundation, etc

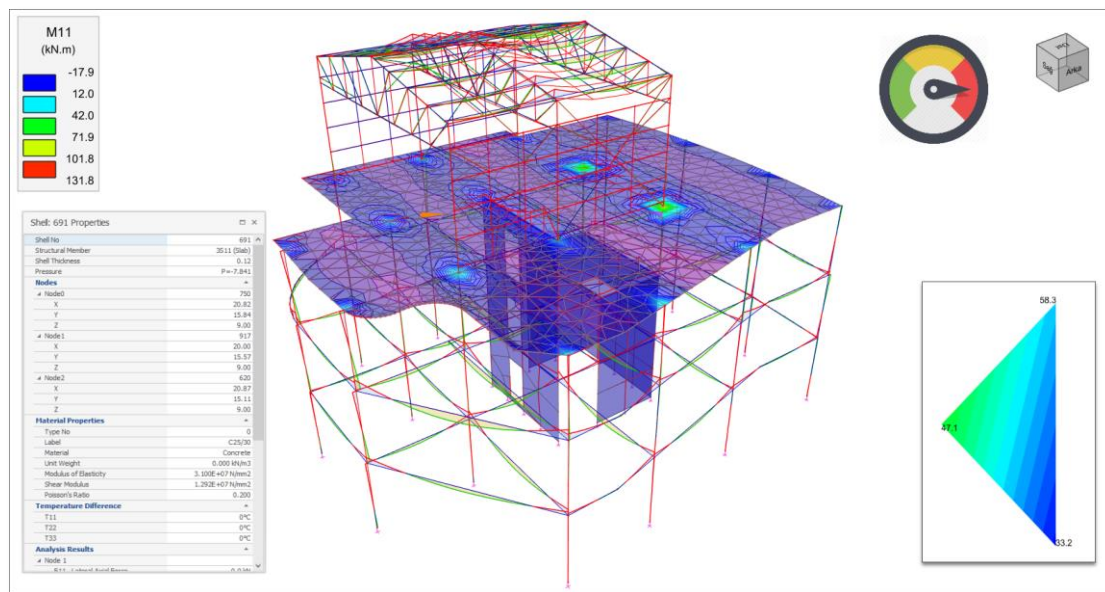


# Analysis

## New Analysis Post Processor

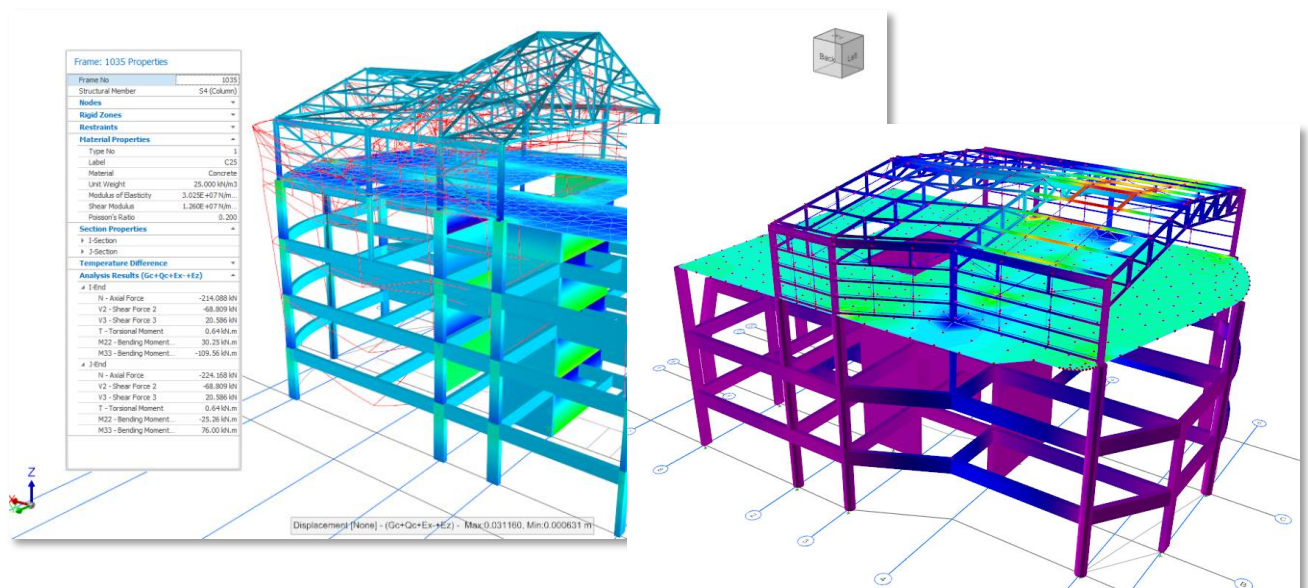
### A Faster, Integrated Experience

The new integrated 64-bit Analysis Post Processor provides significantly superior performance with the help of the latest graphics technologies and methodologies. Displacement animations, diagrams, and contouring are now much faster. Switch instantly between analysis and model displays or tile them for concurrent viewing.



### Solid Analytical Model View

See results in our new Solid Analytical model. Enjoy the harmony of physical members dressed in color-coded analytical results.



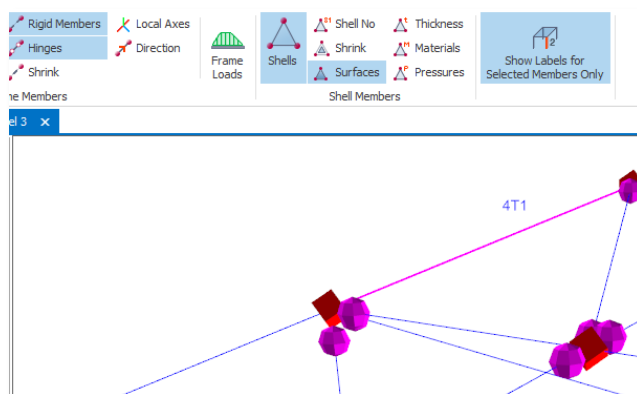
## Pushover and Time-History Analysis Results Display

If you have performed a nonlinear Pushover or Time-History Analysis, the new analysis post-processor will allow you to visualize the results including time steps and progressive pushover behaviour.



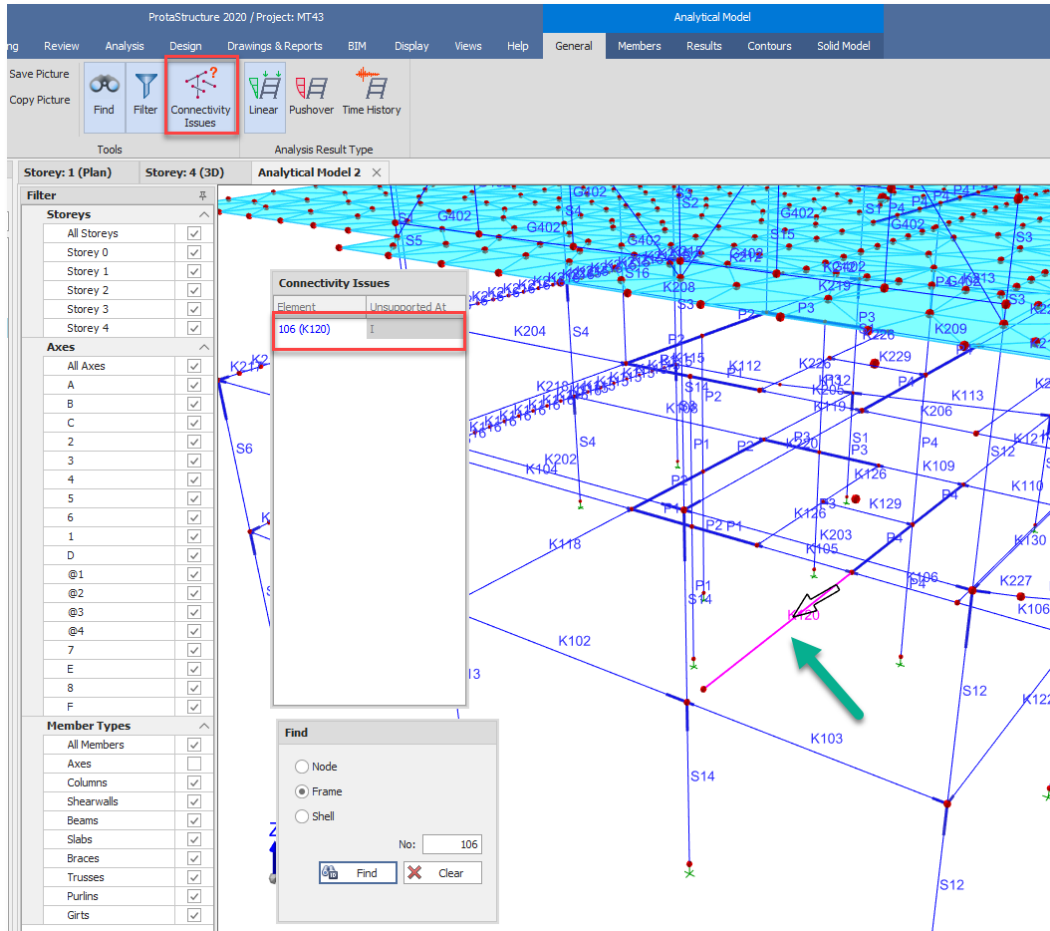
## Display of Selected Results

It can be hard to navigate analytical views through complex models. ProtaStructure allows you to show labels for selected members only to allow you focus on what you are working on.



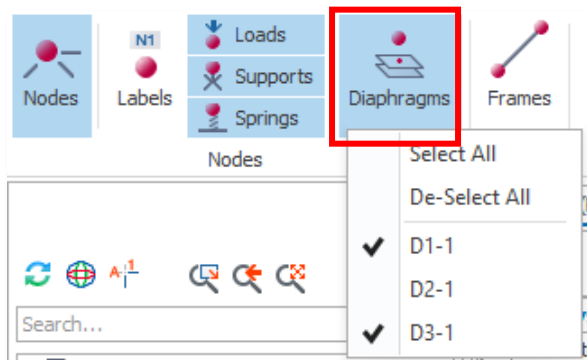
## Connectivity Helper

*Connectivity issues* function lists all the frames with suspicious support and connectivity conditions. You can revise and highlight any frame from that list.



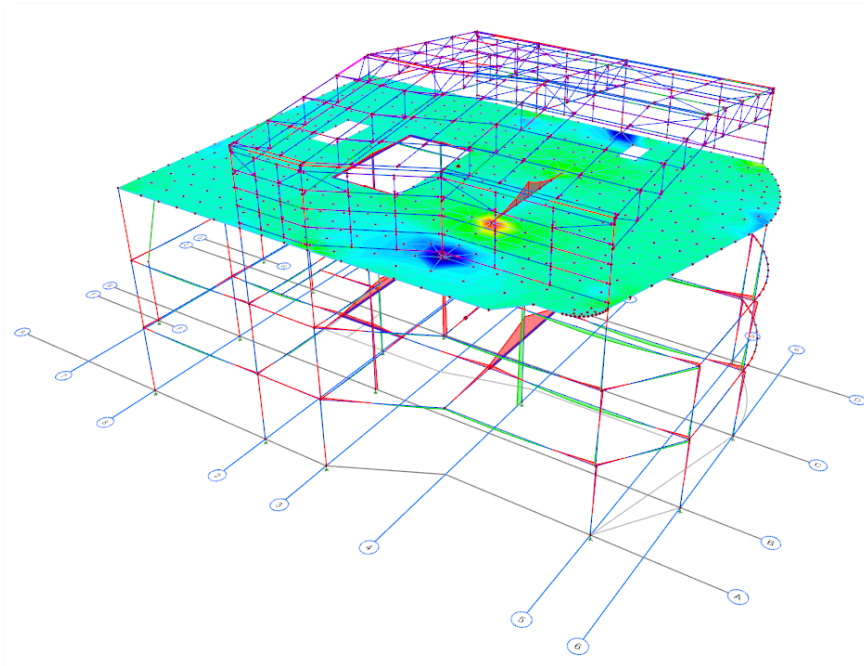
## Diaphragms

Visibility of each diaphragm can be set independently



## Grid Layout

Analytical views can show model positioned on the actual grid system



## Nonlinear Analyses with ProtaStructure- OpenSees Integration

This feature was originally introduced in ProtaStructure 2019 but further enhanced in 2020.

### What is OpenSees?

The **Open System for Earthquake Engineering Simulation (OpenSees)** is a software framework for simulating the seismic response of structural and geotechnical systems. OpenSees has been developed as the computational platform for research in performance-based earthquake engineering at the [Pacific Earthquake Engineering Research Center](#).

OpenSees has advanced capabilities for modeling and analyzing the nonlinear response of systems using a wide range of material models, elements, and solution algorithms. The software is designed for parallel computing to allow scalable simulations on high-end computers or for parameter studies.

OpenSees provides beam-column elements and continuum elements for structural and geotechnical models. A wide range of uniaxial materials and section models are available for beam-columns.

Nonlinear analysis requires a wide range of algorithms and solution methods. OpenSees provides nonlinear static and dynamic methods, equation solvers, and methods for handling constraints.

OpenSees is open-source. The [open-source](#) movement allows earthquake engineering researchers and users to build upon each others accomplishments using OpenSees as community-based software.

(Source: <https://opensees.berkeley.edu/OpenSees/home/about.php>)

### Automatic Transfer of Analysis Model and Nonlinear Material Properties

ProtaStructure analytical model is communicated to OpenSees via TCL files. In addition to the detailed analytical model, nonlinear material properties are also automatically calculated and added on top of this model. The entire structure is then ready for performance analysis.

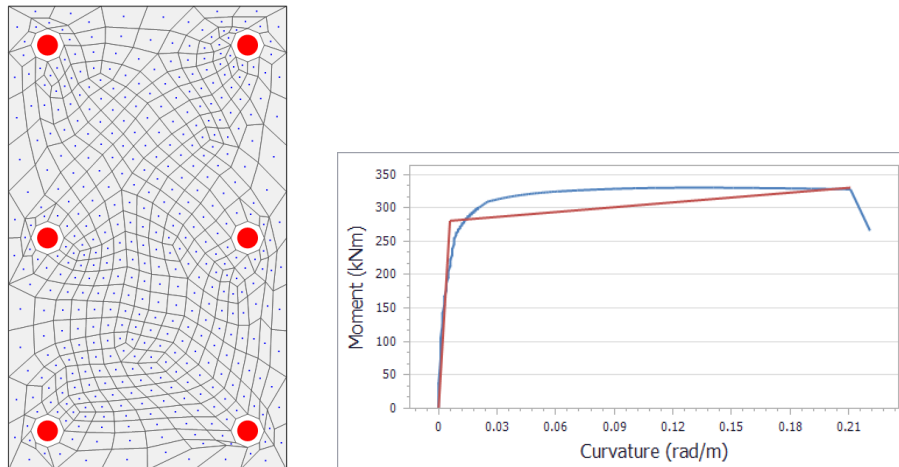
Due to license rules, we are not distributing **OpenSees.exe** with ProtaStructure. You can download it from <https://opensees.berkeley.edu/OpenSees/user/download.php> and copy to the ProtaStructure installation folder (default C:\Program Files (x86)\Prota\ProtaStructure2019EN).

TCL/TK libraries must also be downloaded.

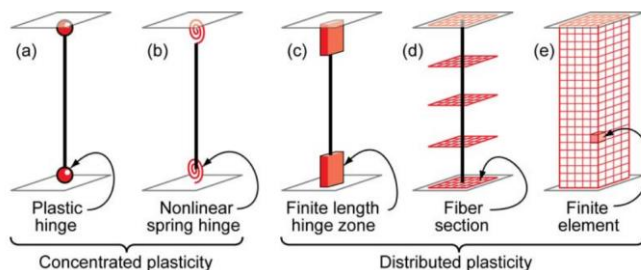
### Nonlinear Fiber Analysis of Sections

Column, beam, and Wall sections can be modeled with fiber elements and analyzed with state-of-the-art numerical techniques to derive the Moment-Curvature relationships. Confined and unconfined concrete regions can be specified. Strain hardening is taken into consideration. For more accurate analysis, you can create the fiber mesh around rebars.

The user interface for fiber section analysis is not released yet, however, the underlying technology is used to derive the force-deformation relationships of the members for pushover and Time-history analysis. The meshed picture below is provided to give you an idea.



For column and wall members, a ‘Finite Length Hinge Zone’ model with 6 integration points is used. Shearwall members are modeled with a **distributed plasticity** model, again with 6 integration points. Force-deformation relationships for integration points are obtained from fiber section analysis.



## Nonlinear Static Pushover

Single Mode Static Pushover analysis is performed using **ProtaStructure - OpenSees** integration. Plasticity models are used as described above. Parameters such as the number of steps and target displacements can be controlled by the user.

After the analysis, the Capacity Curve is obtained. Users can specify the monitored node for which the curve will be generated. Results can be examined at any desired step. A detailed **performance assessment report** is generated after. Nonlinear static pushover is accessible at **Analysis > Building Assessment** menu.

Column Table (Dir:0°)

Column	Storey	L-Net (cm)	bx by (cm)	N <sub>top</sub> N <sub>base</sub> (t)	V <sub>top</sub> V <sub>base</sub> (t)	M <sub>top</sub> M <sub>base</sub> (t.m)	M <sub>ytop</sub> M <sub>ybase</sub> (t.m)	M <sub>ztop</sub> M <sub>zbase</sub> (t.m)	Capacity Reduction Factor	V / V <sub>storey</sub>	Failure Type	Strong Column	θ <sub>u</sub> (rad)	θ <sub>y</sub> (rad)	θ <sub>y (S.D)</sub> (rad)	θ <sub>y (C.D)</sub> (rad)	θ <sub>y (CP)</sub> (rad)	Section Damage Region
S1 - I	1	50.00	30.00	-38.240	-3.435	-1.75	15.29	17.98	0.750	0.0535	Ductile	X	0.0163	0.0000	0.0000	0.0364	0.0486	Limited
S1 - J	250.00	30.00	-39.365	-3.435	8.56	15.41	18.13		0.750	0.0535	Ductile	✓	0.0001	0.0137	0.0000	0.0364	0.0486	Significant
S2 - I	1	50.00	30.00	-70.102	-4.613	-3.14	18.43	21.69	0.750	0.0738	Ductile	X	0.0163	0.0000	0.0000	0.0376	0.0502	Limited
S2 - J	250.00	30.00	-71.227	-4.613	10.70	18.51	21.77		0.750	0.0738	Ductile	✓	0.0002	0.0136	0.0000	0.0376	0.0502	Significant
S3 - I	1	50.00	30.00	-70.319	-4.469	-2.47	18.69	21.99	0.750	0.0520	Ductile	X	0.0165	0.0000	0.0000	0.0423	0.0564	Limited
S3 - J	250.00	30.00	-71.444	-4.469	10.93	18.76	22.07		0.750	0.0520	Ductile	✓	0.0002	0.0135	0.0000	0.0423	0.0564	Significant



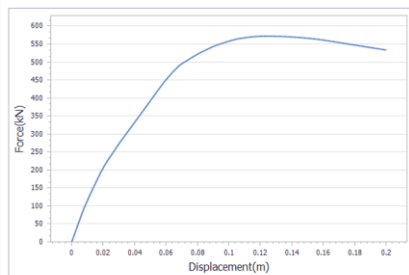
### Performance Goal: Controlled Damage - Earthquake Level: DD2 Assessment Report

#### Performance Assessment Report

Earthquake Level	Performance Goal	Direction	Most Critical Storey	Determined Building Performance Level	Status
DD2 - Controlled Damage	DD2	0	1	Controlled Damage	Not Satisfied

Earthquake Level: DD2 - Performance Goals are not Satisfied ✗

#### Pushover Curve



Monitored Node: 100

Target Displacement (m): 0.2

Pushover Analysis Type: Equivalent Static Pushover Analysis

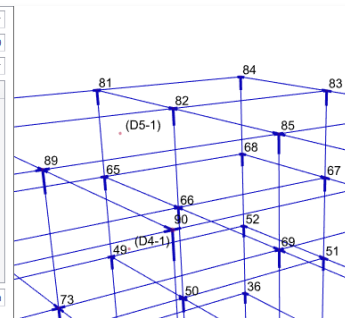
Total Number of Steps: 100

Pushover Direction: 0-Degree

Control Node:

Selection	Node	Storey
<input checked="" type="checkbox"/>	D5-1	5
<input type="checkbox"/>	96	5
<input type="checkbox"/>	95	5
<input type="checkbox"/>	94	5
<input type="checkbox"/>	93	5
<input type="checkbox"/>	92	5
<input type="checkbox"/>	91	5
<input type="checkbox"/>	90	5
<input type="checkbox"/>	89	5
<input type="checkbox"/>	88	5
<input type="checkbox"/>	87	5

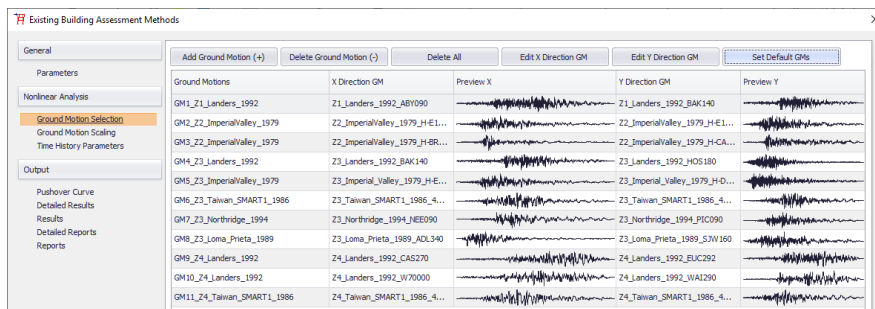
Target Displacement: 0.109638 m



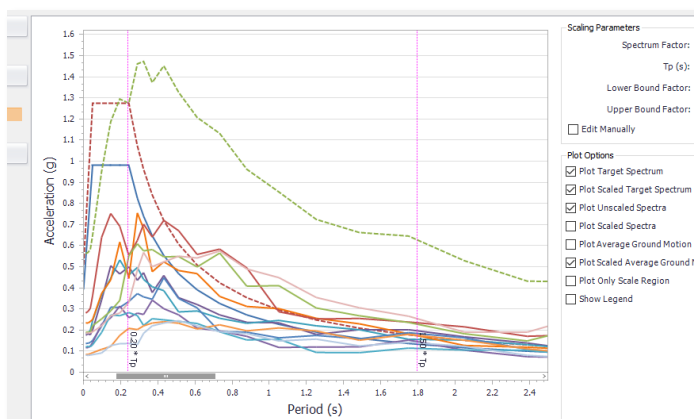
## Nonlinear Time-History Analysis

A nonlinear Time-History analysis can be performed using **ProtaStructure - OpenSees** integration. Plasticity models are used as described above.

A set of multiple ground motions can be applied simultaneously in X and Y directions. As specified by the earthquake codes, the ground motion application direction is rotated by 90 degrees, and analyses are repeated. The selection of suitable ground motions is up to the user. Parameters like fault mechanism, soil properties, magnitude are of importance. Nonlinear time-history analysis is accessible at **Analysis > Building Assessment** menu

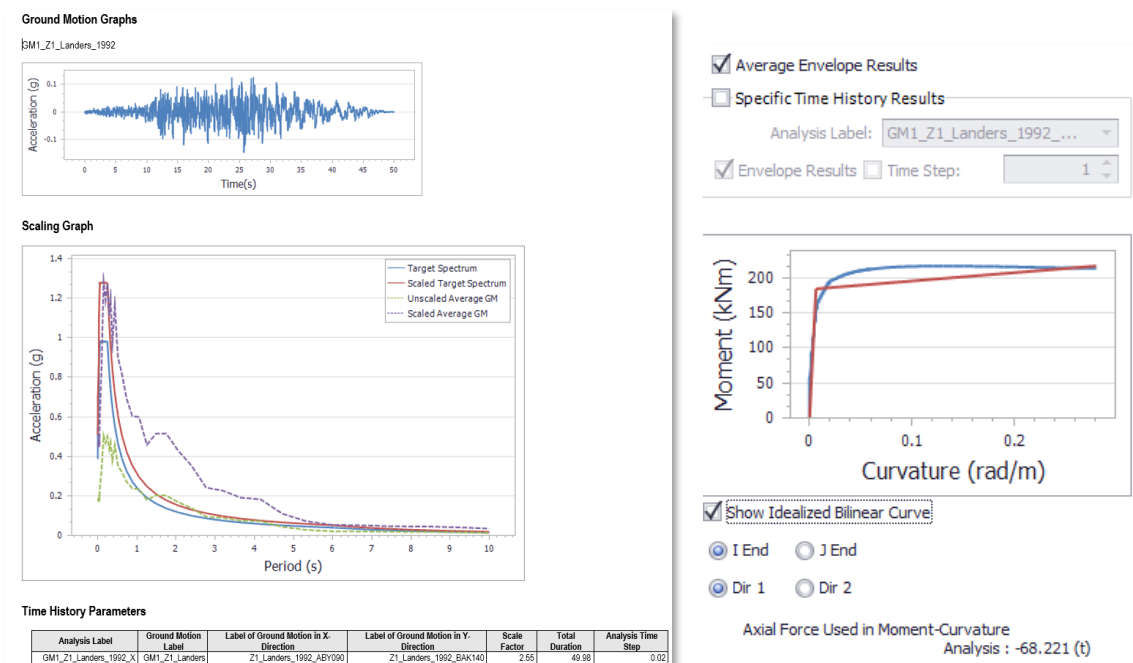


The selected ground motion records are automatically scaled by ProtaStructure using the **simple scaling method** between 0.2T and 1.5T.



The analysis results from multiple ground motion sets are automatically post-processed. The average values of absolute maximum responses are extracted and used in performance assessment.

A detailed performance assessment report is presented. Additionally, the analysis results for a specific ground motion at a specific time-step can be looked up by the user.





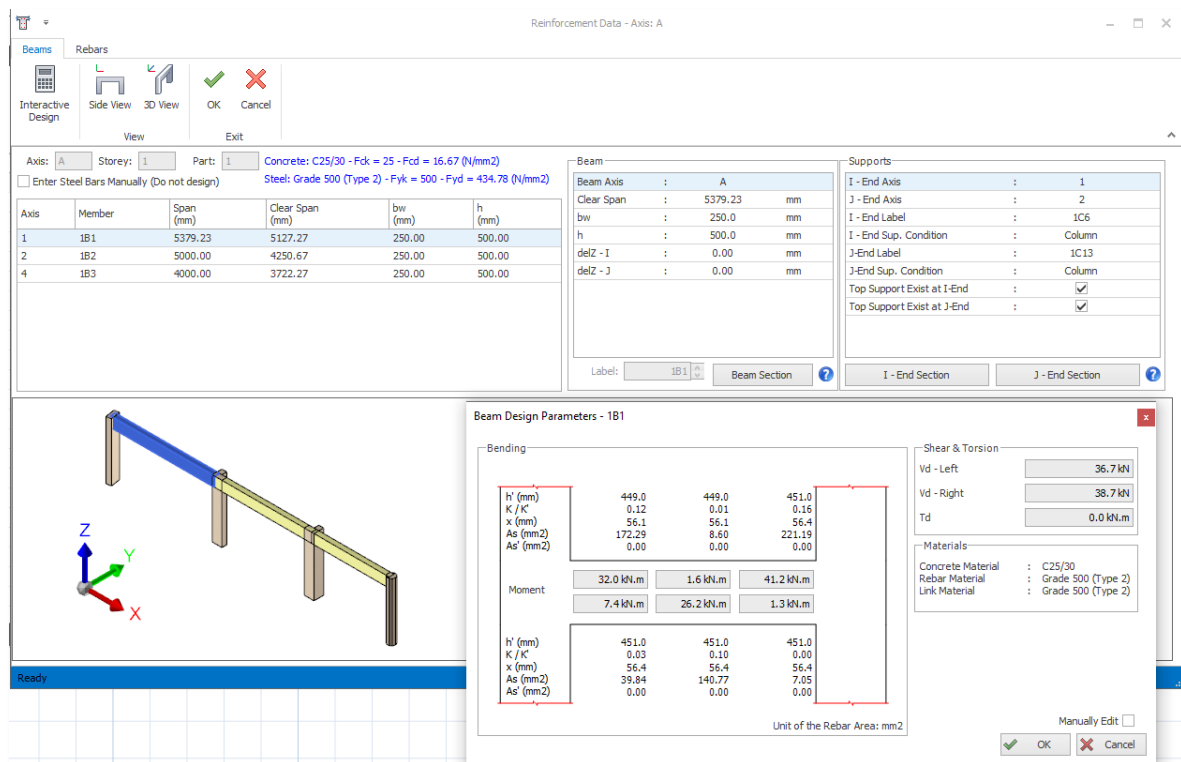
## RC and Steel Design

### New RC Beam Design Module

RC beam design module is remastered and improved with better usability, visualization and new features.

### Beam Design Editor: Familiar Interface, Better Technology

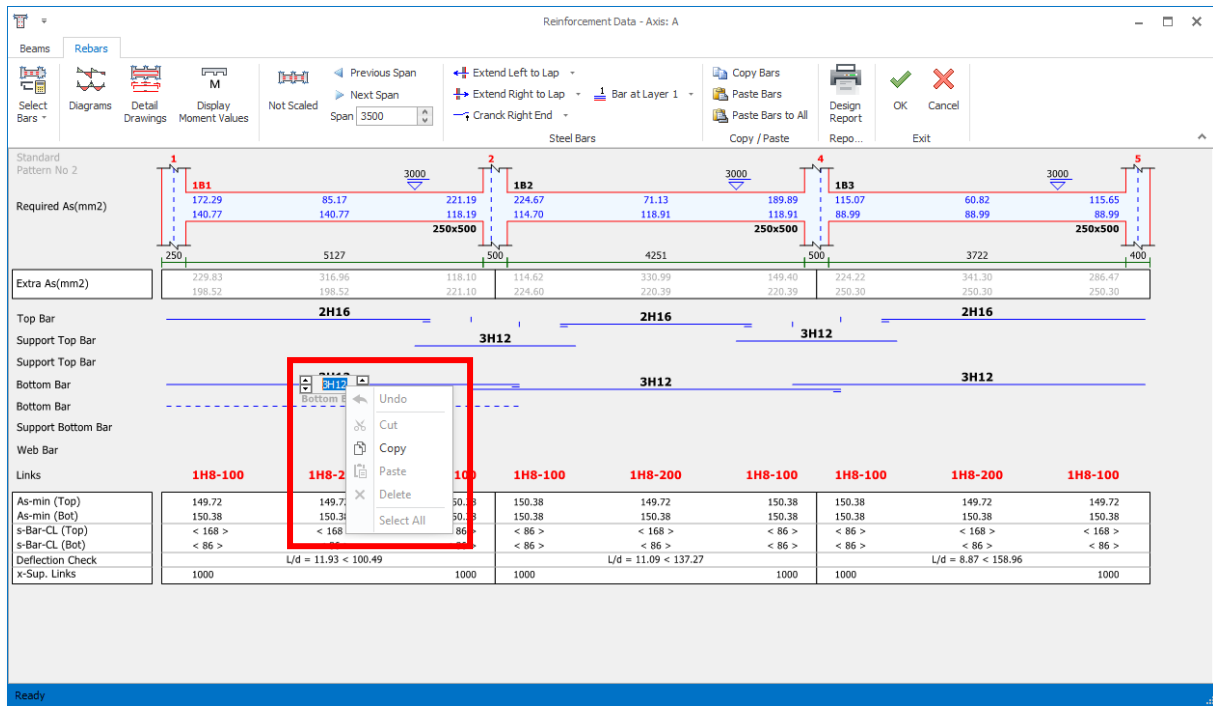
You can see beams of design axis in 3D and manipulate the geometry easily with visual feedback. More detailed information is available on design parameters for selected concrete code.



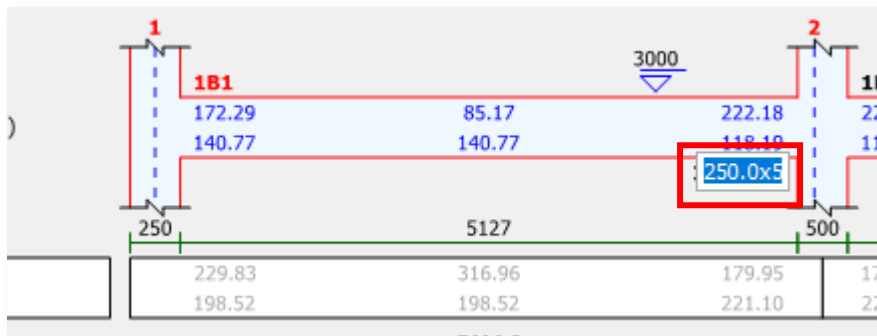
### Copy/Paste Rebars to the Neighboring Beams

Selected rebars can be copied to the clipboard using right click or simply Ctrl+C combination. Then you can paste them multiple times to different targets using Ctrl+V.

The whole rebars of a selected beam can be copied to multiple neighbours using *Copy Bars*, *Paste Bars* and *Paste Bars to All* buttons. The support bars will be copied intelligently taking level differences into account.

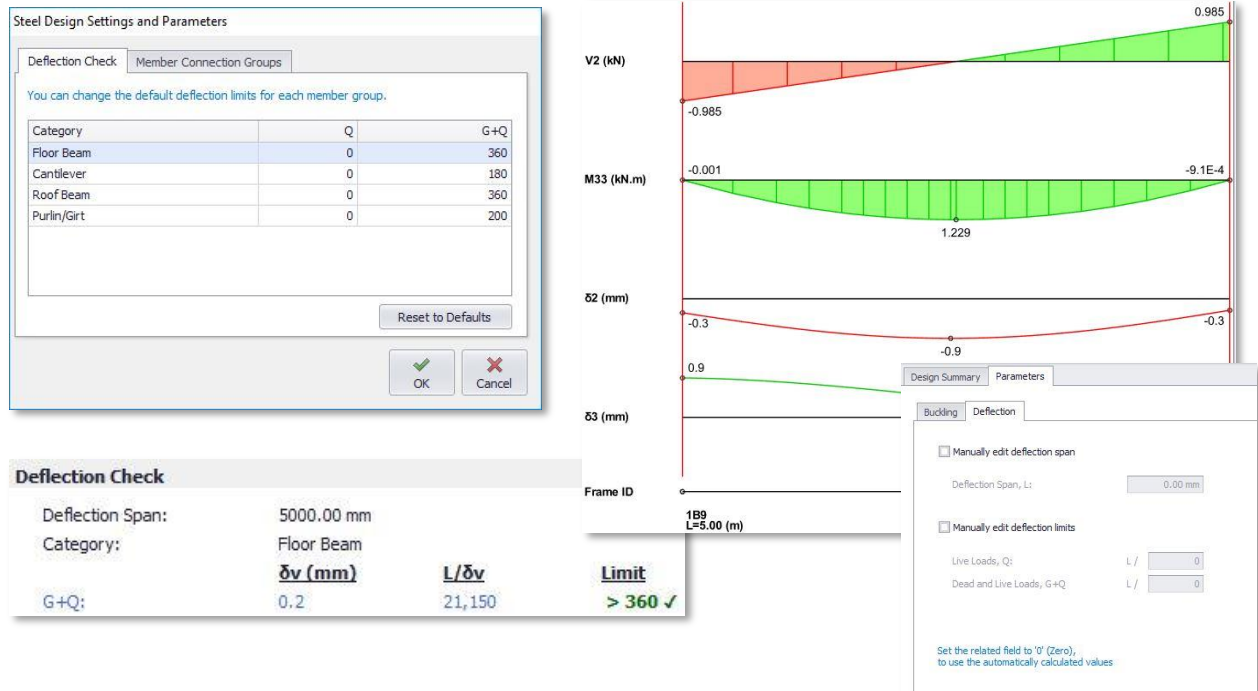


Beam section dimensions can be changed without leaving the rebar selection. Simply click on the dimensions text and amend.



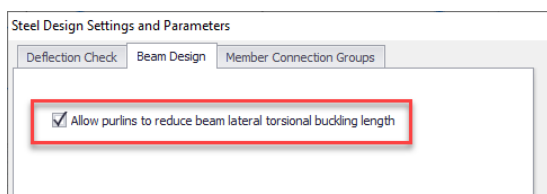
## Steel Deflection Checks

The deflection of steel members can now be checked to EC3, BS5950, AISC360 and TSC2016 codes. You can modify the deflection limits for different member groups using the “**Settings > Steel Design Settings and Parameters**” menu. Additionally, you can override ‘Deflection Span’ and ‘Deflection Limits’ for each member.



## Improvements in Steel Beam and Truss Design

Significant improvements are made in buckling length calculations of steel beams, top and bottom chords. Detection of connecting members such as horizontal braces, purlins and beams are significantly enhanced. Additionally, a new option is introduced to consider the effect of purlins on beam buckling length calculations.

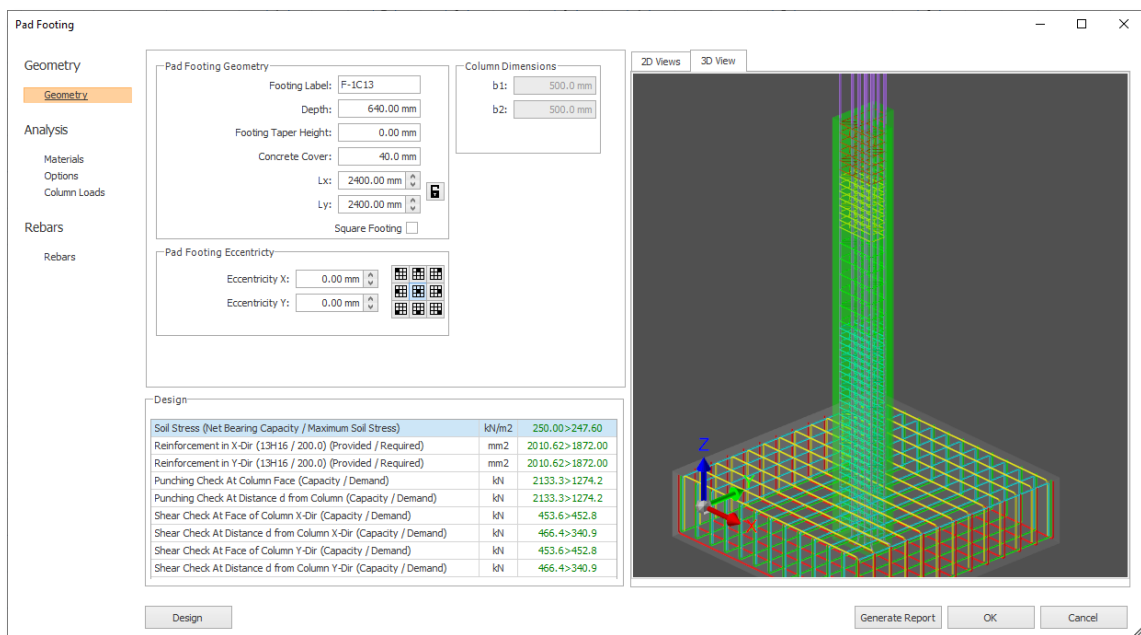


# Foundation Design

## New Pad Footing Module

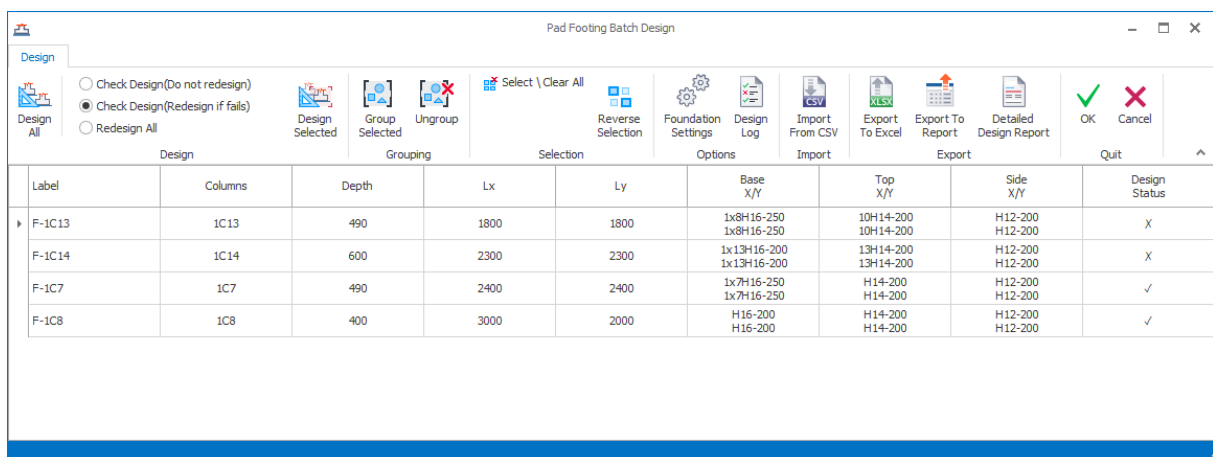
ProtaStructure 2020 introduces a new pad footing design which brings new functionalities:

- Automated design for depth.
- Top and Bottom bars can be separately edited and introduced.
- More transparent and interactive design experience.
- 3D rebars are visualized and used in detailing.



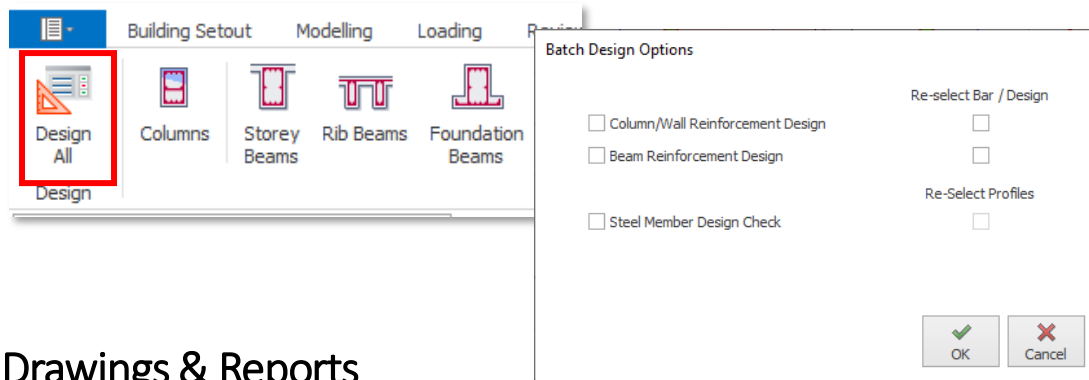
## Batch Design of Pad Bases

When multiple vertical members are selected to insert pad footing a batch interface is opened to allow you to design all at once. You can group selected items or import a set of pad footings from CSV or Excel files. Batch reports can be prepared or design can be revised any time from the same interface.



## Design All

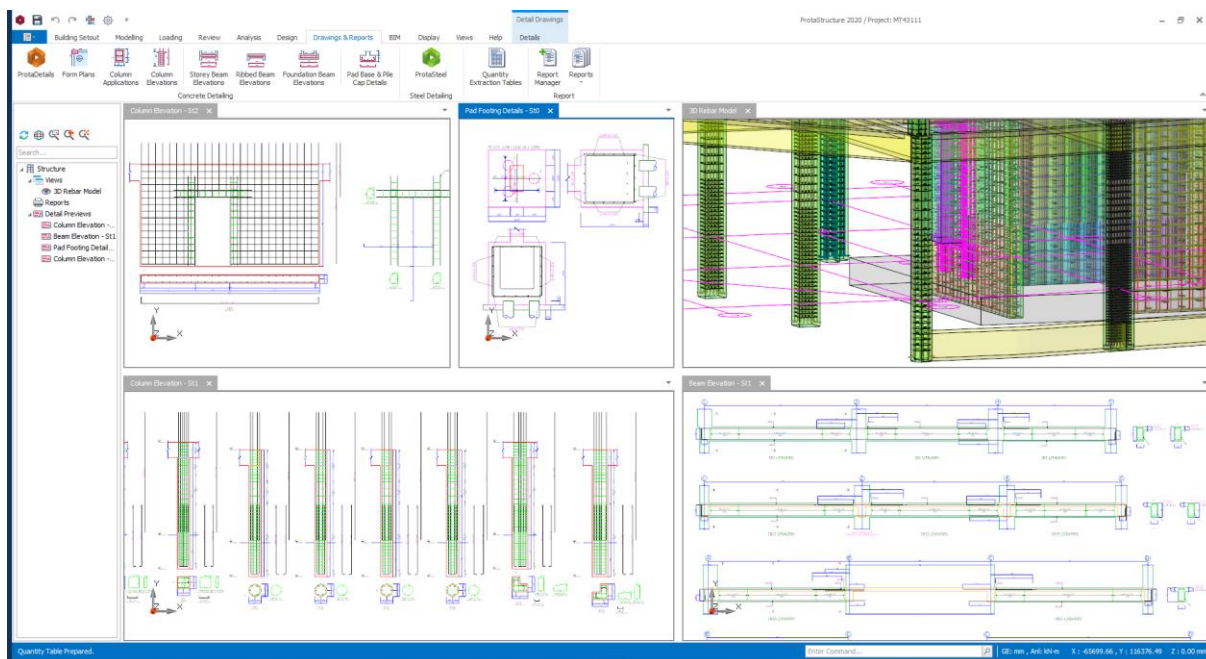
A single intuitive interface is available for fast access to design all members in the model at once.



## Drawings & Reports

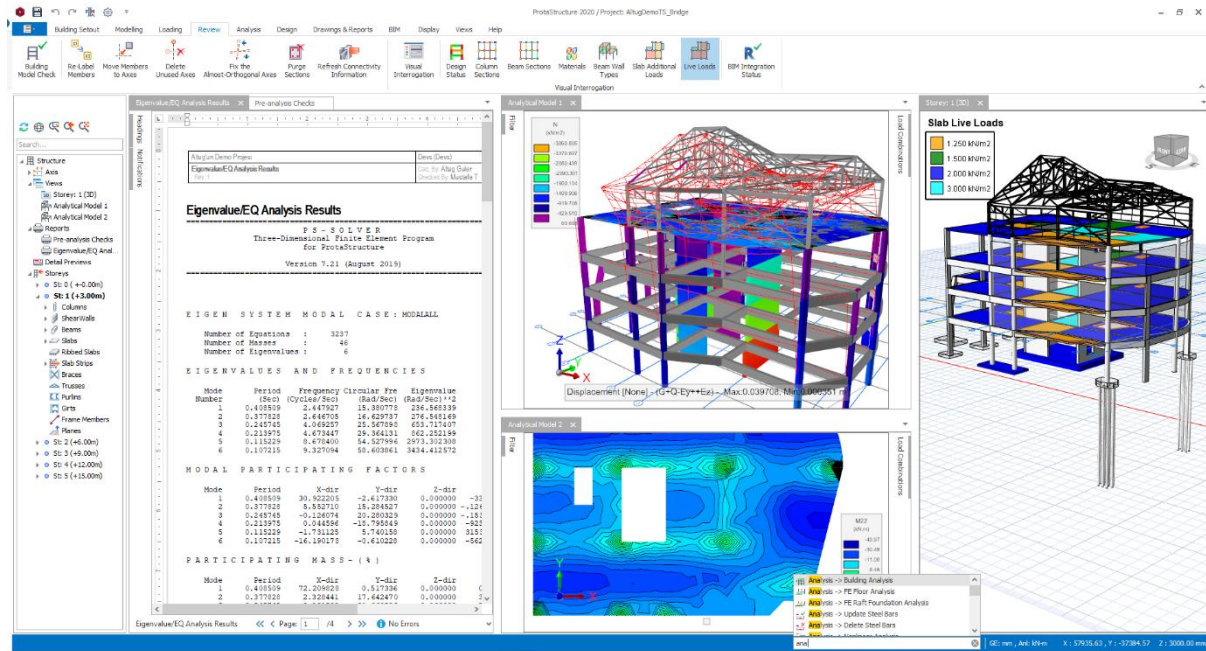
### Detail Drawing Preview

Preview your RC detail drawings and make sure that everything is in place before switching to ProtaDetails.



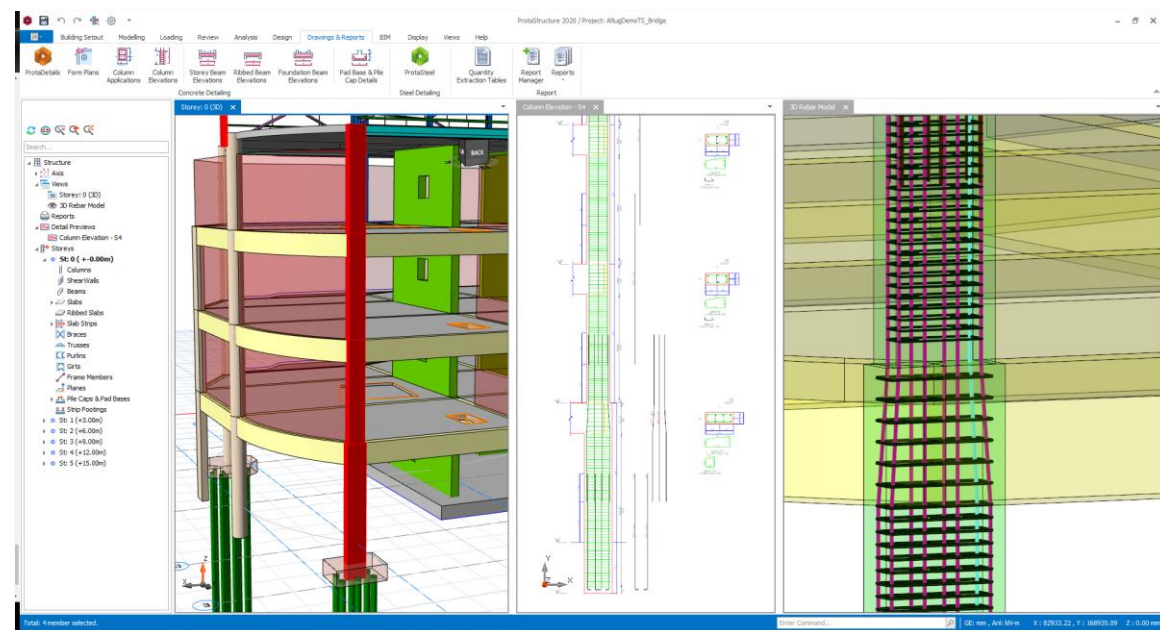
## Embedded Reports

Analysis and design reports can be displayed in a separate docking panel just like a regular view. It is more integrated and convenient this way for you to review the reports while reviewing the models at the same time. You can even tear out the docking panel and place it on your second screen.



## 3D Rebar View

Detail drawings are extracted from a central 3D model in ProtaStructure. Now rebar detailing can be viewed in 3D as well. See how containment is conducted precisely in 3D.



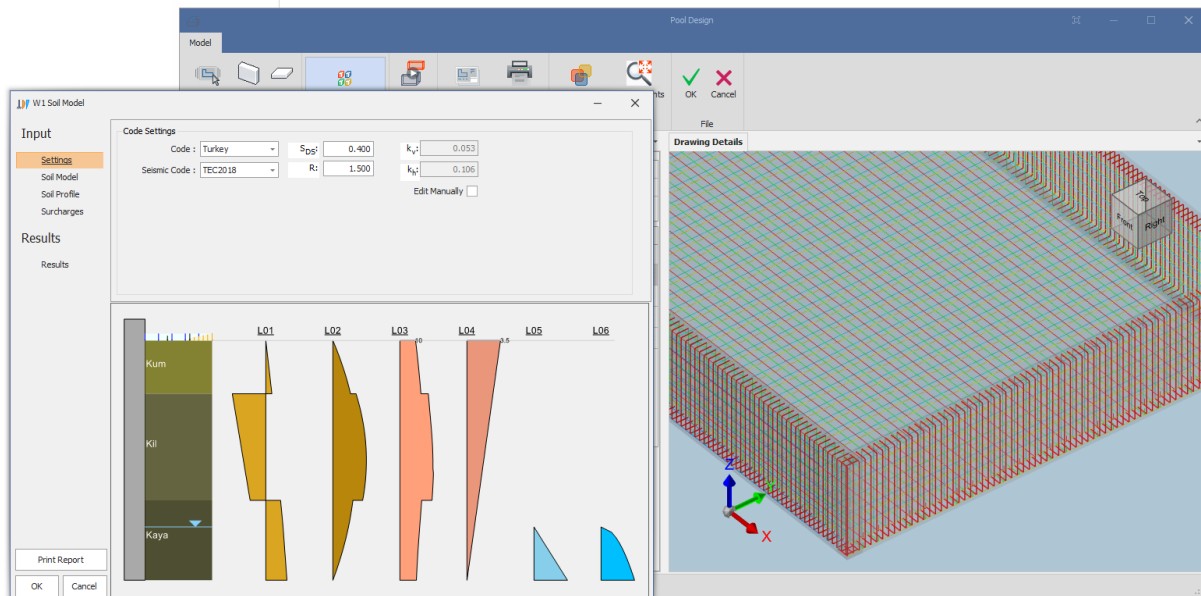


## ProtaDetails 2020

ProtaDetails 2020 enhances and refines productivity with automated reinforced concrete detailing, drawing management and dwg drafting, together with our growing library of element design and detailing macros

### New 3D Pool Analysis, Design and Detailing Macro

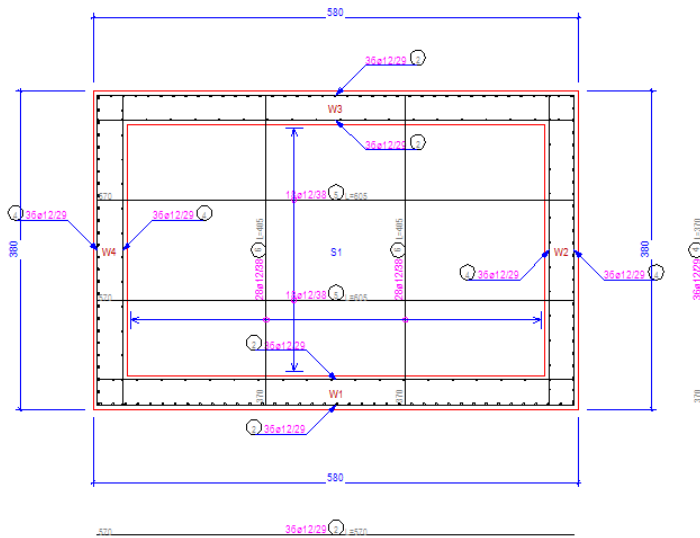
A new pool macro is introduced. Setting the shape of the pool is very simple. You can use preset geometries from the library or just edit the plan coordinates. Moreover, you can define different soil models for each wall stem according to US and European standards. Stability checks, seismic, and RC design under design and service scenarios are done automatically, and rebars are visualized in 3D.



### A Glimpse to the Future of ProtaDetails: 2D Details from 3D Information

3D visualization of the rebars is not just a static display. All the 2D drawings are automatically generated from 3D rebar definitions. This yields much more efficient and accurate detail production as well as quantity take-off.



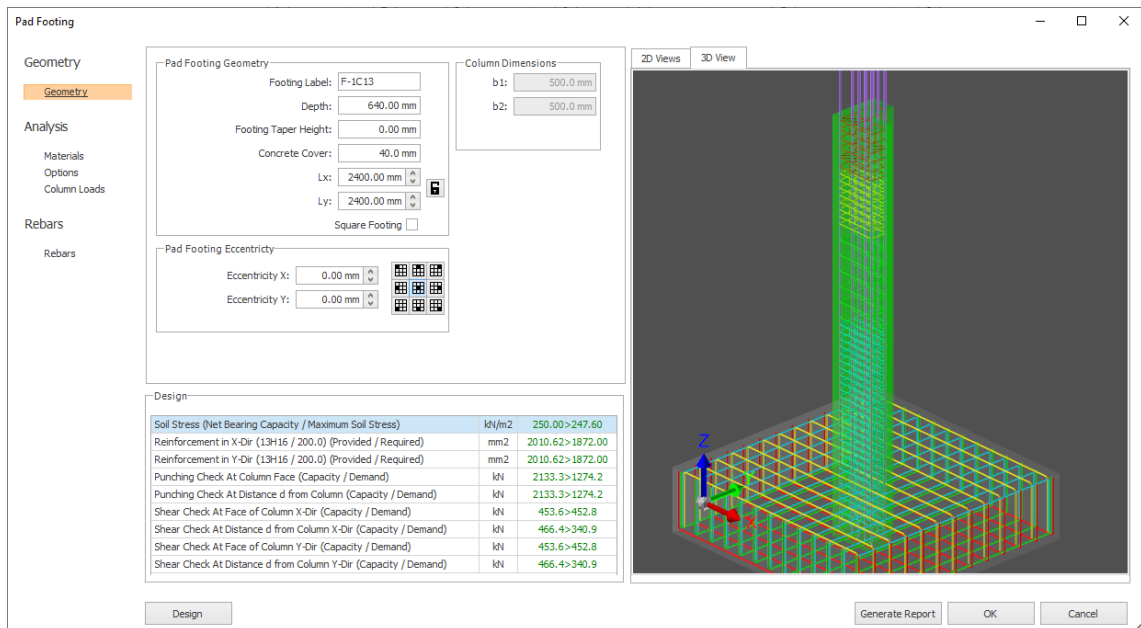


Pool Quantity Table					
SIZE	UNIT WEIGHT (Kg/m)	LENGTH (m)	T.WEIGHT (Kg)		
ø12	0.889	758.8	674.5		
ø24	3.556	381.9	1,357.9		
T.WEIGHT (Kg)			2,032.4		
NO	SIZE	QUA	LENGTH (cm)	TOTAL	FORM
1	24	134	285	381.90	134
2	12	36	570	205.20	36
3	12	70	285	199.50	70
4	12	36	370	133.20	36
5	12	18	602	108.36	18
6	12	28	402	112.56	28

## New Pad Footing Module

ProtaDetails 2020 introduces a new pad footing design library which brings new functionalities. This is the exact same design module used in ProtaStructure. You can use it independent of ProtaStructure using your own analysis results and prepare the documentation.

- Automated design for depth.
- Top and Bottom bars can be separately edited and introduced.
- More transparent and interactive design experience.
- 3D rebars are visualized and used in detailing.



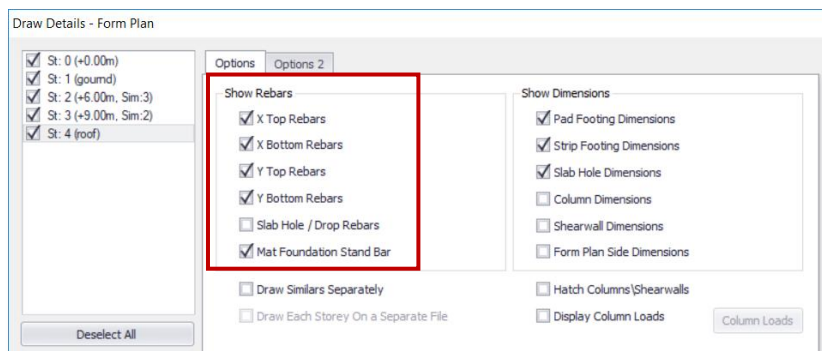
## RC Slab Cross-Sections with Reinforcement Detailing

This feature was originally introduced in ProtaStructure 2019 but further enhanced in 2020.


Reinforced slab cross section can be created with reinforcement detailing. In ProtaDetails, cut sections anywhere along the layout plan drawing and position it anywhere within the drawing sheet.

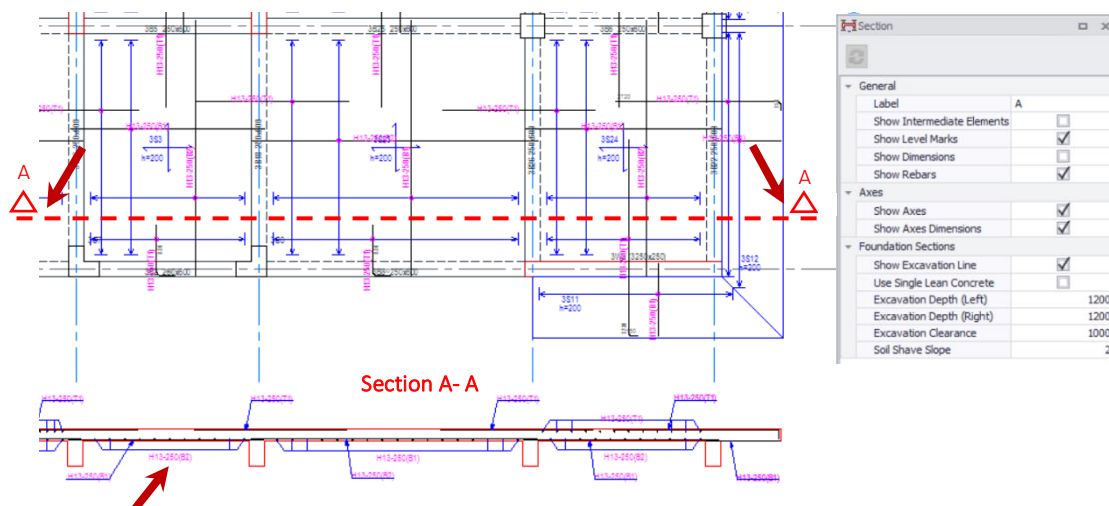
### How to Use

- In ProtaStructure, ensure that all the slabs reinforcement has been designed using slab strips.
- Go to **Concrete Design > Load ProtaDetails**
- Generate the Form Plan drawing ensuring options to **Show Rebars** are checked




**Tip** : More slab detailing options are available in the **Options 2** tab.

- Go to **Detail Library** (top menu) > Pick **Plan Sections** 
- Alternatively, in the **Command** line at the bottom, type **"FormSection"**
- In the **Section** dialog, input / select the preferred options
- Draw a "section cut" line by clicking on 2 points on the plan view



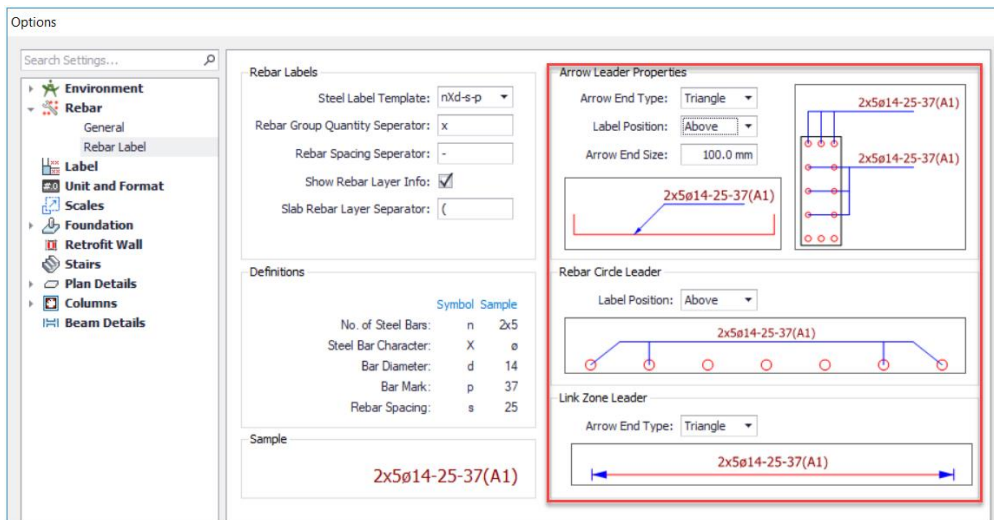
- Click on the desired location to place the section detail

**Tip** : Click  (orthogonal) icon right at the bottom to ensure the line is exactly horizontal/vertical.

## New Rebar Label Settings

This feature was originally introduced in ProtaStructure 2019 but further enhanced in 2020.

Rebar label settings has been enhanced to allow for more user-defined options for arrow leaders (pointing to rebars) and dimensions arrows. This offers greater flexibility for users to produce high quality drawings to their company standards. This is accessible to **Settings** (top menu dropdown) > **Rebar** > **Rebar Label**.

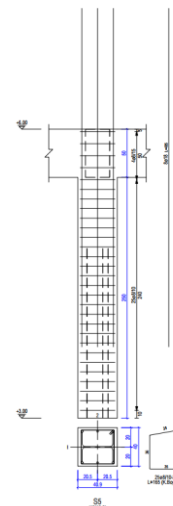
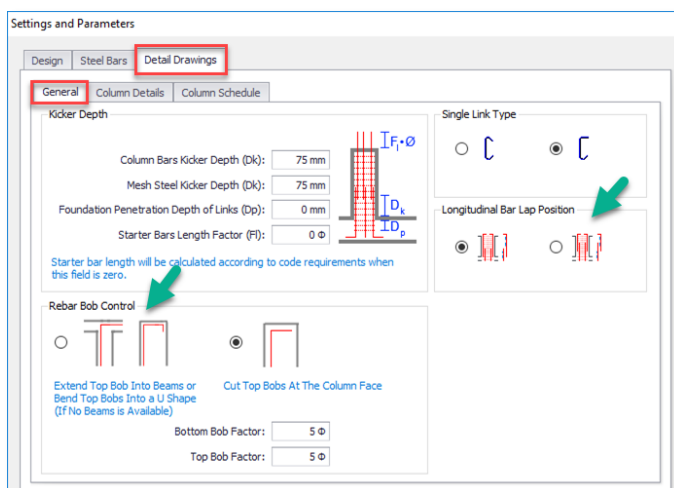


## Enhanced Column & Beam Detailing Settings & Drawings

This feature was originally introduced in ProtaStructure 2019 but further enhanced in 2020.

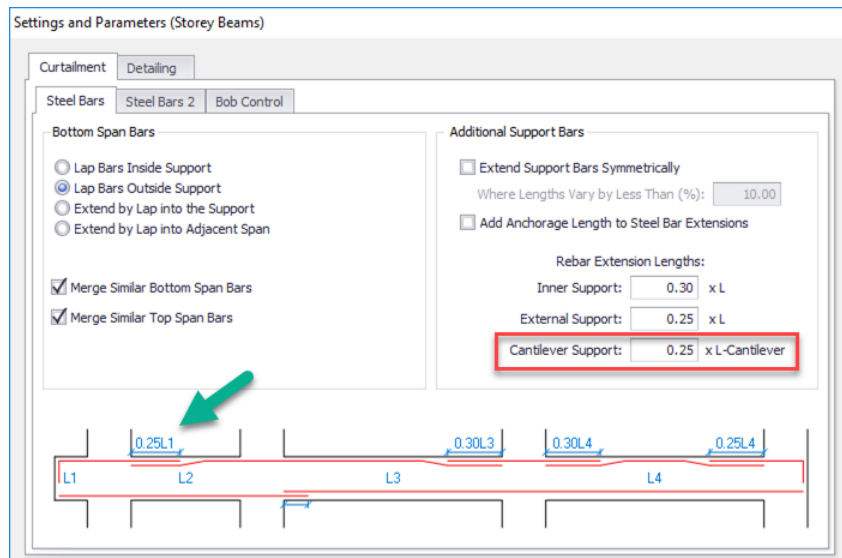
Numerous new column and beam detailing options are introduced to enhance the quality of drawings. For column elevations drawings, longitudinal bars can be lapped in the mid-span of the column (requirement of some code of practice) & bending of bars (BOB) can be controlled.

These new options are accessible to **Settings** (top menu dropdown) > **Column Settings** > **Details Drawings** > **General** tab.



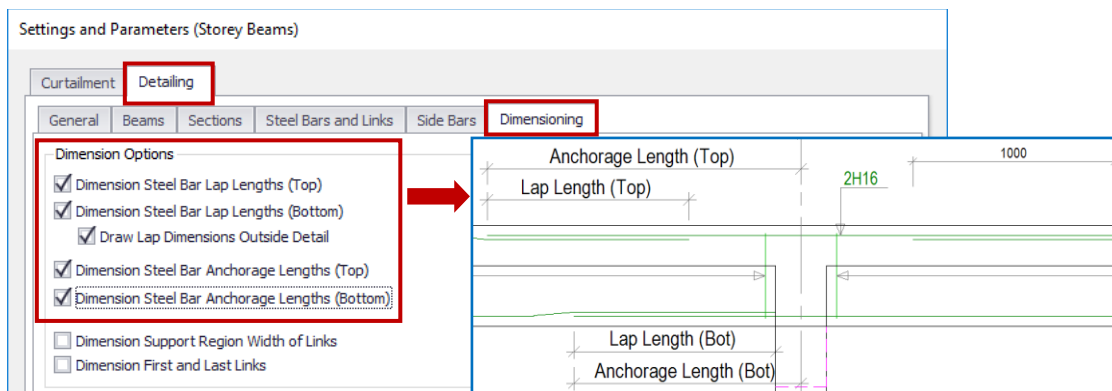
The beam elevation detail is also enhanced significantly. Cantilever top rebar extension lengths can be adjusted based on a user-defined factor multiplied by the cantilever length. This feature is implemented to cater for some user's preference for this manner of cantilever beam detailing.

This feature accessible via **Settings** (top menu dropdown) → **Beam Settings** → **Steel Bars** tab.



**Note :** A minimum length of **Inner & External support** will be applied if the resultant cantilever support length is less than the former.

The dimension options of lap & extension (or anchorage) are separated for top and bottom bars to cater for different users' preference. These options are accessible via the **Detailing** → **Dimensioning** tab.



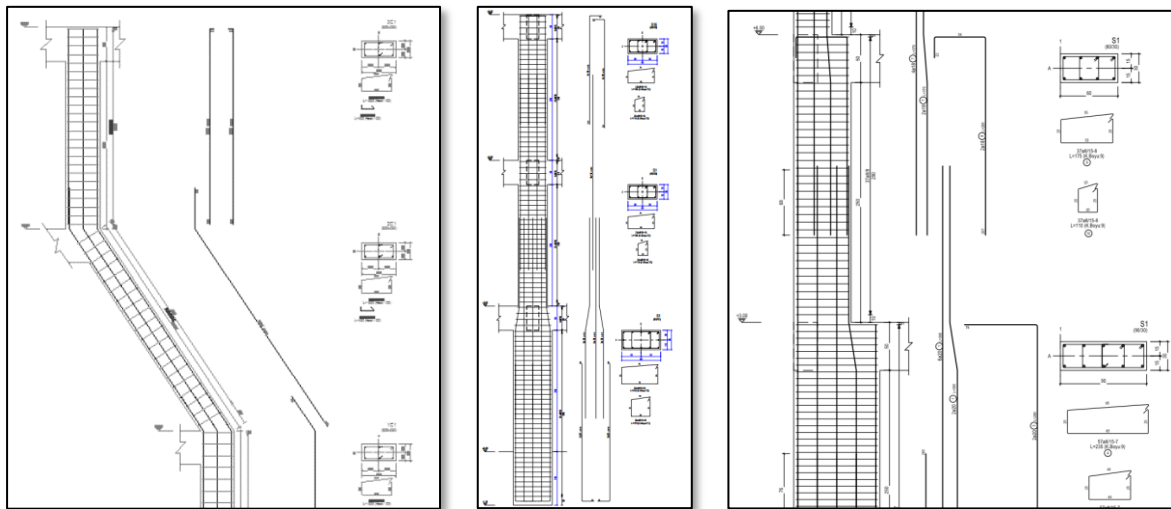
- The column & beam detailing settings are directly inherited from ProtaStructure where the exact same settings exist.
- Any changes to the settings in ProtaDetails will only affect new details; existing beam details remains unchanged.
- Changes in settings in ProtaDetails cannot be saved; it will be discarded when ProtaDetails is closed.
- If you want to save changes, please update the same settings in ProtaStructure.
- We strongly recommend you review these settings before producing any drawings.

## Enhanced Precision and Seismic Detailing

This feature was originally introduced in ProtaStructure 2019 but further enhanced in 2020.

### Slanting Columns and Varying Column Section Sizes

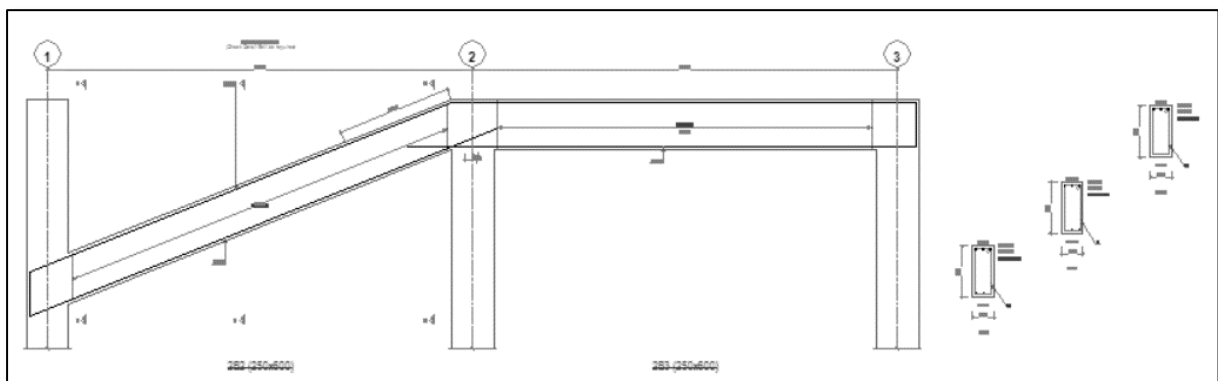
Column elevation detailing is greatly enhanced to include slanting (angled) columns and columns with varying section sizes. Longitudinal bar detailing including intelligent curtailment and bar cranking follows Eurocode and ACI recommendations for columns with changing dimensions. Any beams connected to the columns will be drawn in the elevation as well.



Ensure to tick **“General Column Through Storeys”** in **Options** tab of the **Column Elevation** dialog box.

### Sloping Beams

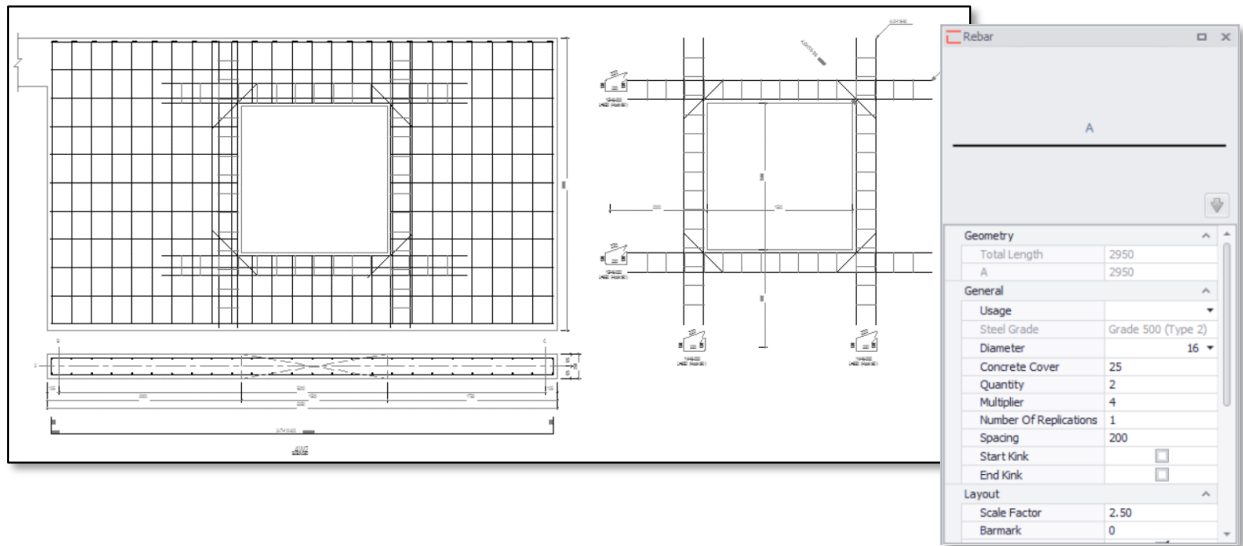
There is significant enhancement in slanting beam detailing; details are more precise and accurate in beam elevation drawings.



## Automatic Wall Opening Detailing

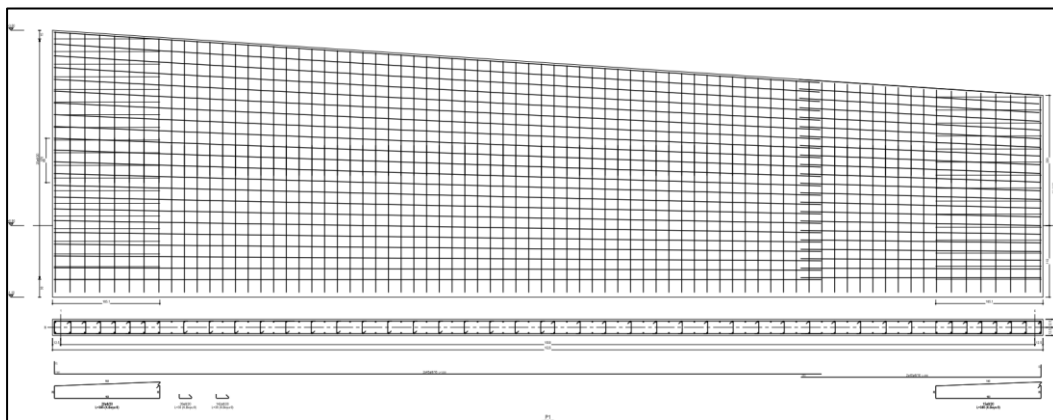
This feature was originally introduced in ProtaStructure 2019 but further enhanced in 2020.

The reinforcement details are automatically created around the shear wall openings in the wall elevation details. The shear wall openings are displayed in both the sections as well as schedules.



The reinforcement detailing around the opening are only suggested rebars; no actual design is performed by the program.

The details can easily be amended by selecting any rebar > the Rebar dialog will appear where changes to size, length & shape can be done.



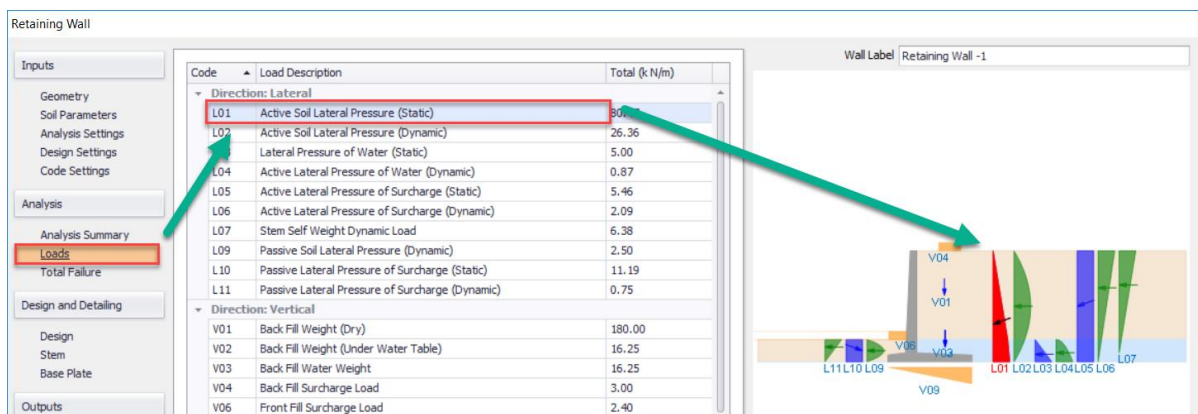
## Enhanced Retaining Wall Module

This feature was originally introduced in ProtaStructure 2019 but further enhanced in 2020.

The retaining wall module is greatly enhanced and now supports the American ACI318 & ASCE7 code. In addition, Eurocode is expanded to cover EC2, EC7 and EC8 with all three design approaches. There are numerous other improvements :

### Enhanced Visualization of Loads

Generated loads can be inspected separately for all parts of the wall for long term and short term analysis. Go to **Loads** > Select a **Load** > Selected load will be colored in red.



### Effect of Shelves on Earth Pressure

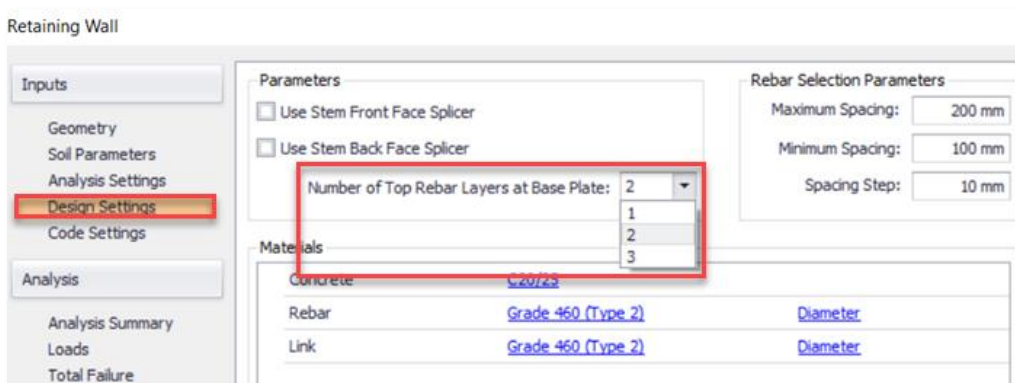
Effect of shelves on lateral earth pressure and fill weights are now applied and is shown in detailed loading scheme.

### New Methods in Total Failure Check

Two different approaches to total failure are introduced; namely Fellenius and Bishop's methods. Go to **Total Failure** > **Analysis Method** > Select **Fellenius / Bishop's Method**

### Multiple Layers of Rebars in Design

New option is introduced to have multiple layers of rebars at base plate. Go to **Design Settings** > **Number of Top Rebar Layers at Base Plate** > Select 1/2/3





## Improved Section Design Methodology

Design approach is changed to be accurately based on reaction/forces at specified sections. Detailed loadings and design forces at each section can be further inspected. Go to **Design > Pick Section Analysis Detail > Select Position** to reveal detail checks.

Retaining Wall

Inputs

Geometry

Sol Parameters

Analysis Settings

Design Settings

Analysis

Analysis Summary

Loads

Total Failure

Design and Detailing

Design

Stem

Base Plate

Outputs

Drawing & Report

Rebar Description

Rebar

Section Analysis

Required/Provided (mm<sup>2</sup>/m)

Stem Back Face Vertical Rebar

6H13-100

S1

1209<1327

Stem Back Face Lateral Distribution Rebar

3H10-140

500<561

Stem Front Face Vertical Rebar

5H10-120

S1

625<654

Stem Front Face Lateral Distribution Rebar

3H10-140

500<561

Base Plate Bottom Rebar

4H10-140

S2 & S3

474<561

Base Plate Back Bottom Distribution Rebar

16H10-160

400<491

Base Plate Front Bottom Distribution Rebar

8H10-160

400<491

Base Plate Top Rebar

5H10-120

S2 & S3

2541<2556

Base Plate Back Top Distribution Rebar

19H10-140

388<393

Base Plate Front Top Distribution Rebar

7H10-140

500<561

Chair Bar

11H10

Tiebar

28H10

☒ Show rebar summary

☐ Show section analysis summary

Section Analysis Details

Redesign

Section Analysis

Position

Distance (mm)

Section Depth (mm)

Load Combination

Md (kNm)

Vd (kN)

Md (kNm)

Md, final = Md + Md \* (0.4\*Vd / (0.4\*Vd + 1))

Stem

400

500

STR/GEO Limit State DA 1 Com...

62.08

-100.27

261.89

213.40

Base

800

400

STR/GEO Limit State DA 1 Com...

0.00

-122.30

25.59

25.59

Base

1300

400

STR/GEO Limit State DA 1 Com...

0.00

198.00

-325.33

-325.33

Load

Active Sol Lateral Pressure (Static)

Active Sol Lateral Pressure (Dynamic)

Lateral Pressure of Water (Static)

Active Lateral Pressure of Water (Dynamic)

Active Lateral Pressure of Surcharge (Static)

Active Lateral Pressure of Surcharge (Dynamic)

Stem Self Weight Dynamic Load

Passive Sol Lateral Pressure (Static)

Passive Sol Lateral Pressure (Dynamic)

Passive Lateral Pressure of Surcharge (Static)

Passive Lateral Pressure of Surcharge (Dynamic)

Self Weight

Static

Dynamic

Static

Dynamic

Static

Dynamic

Dynamic

Static

Dynamic

Static

Dynamic

Static

Active

Active

Active

Active

Active

Active

Passive

Passive

Passive

Passive

Passive

Passive

1.35

1

1.35

1

1.5

1

1

1

1

0

1

1.35

## Easy Identification and Visualization of Rebars

New Design interface allows easy visual identification of various rebars. Go to **Design > Pick a Rebar** > the rebar will be highlighted in **blue** in the diagram.

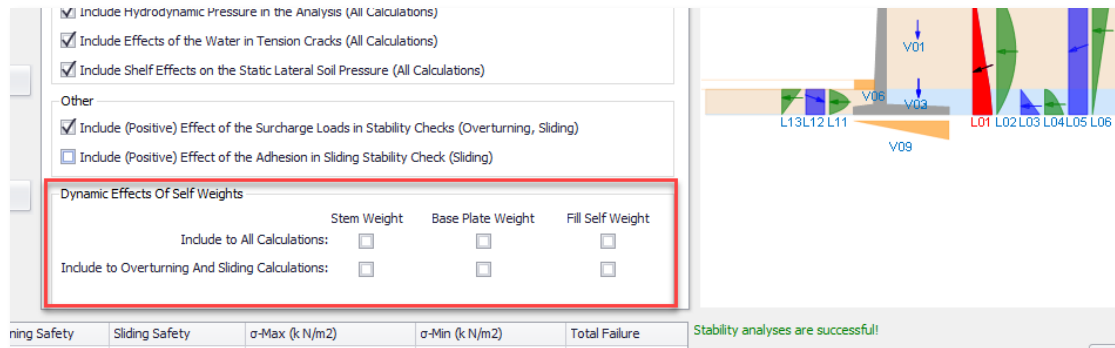
Retaining Wall				Wall Label: Retaining Wall -1	
Inputs	Rebar Description	Rebar	Section Analysis	Required/Provided (mm <sup>2</sup> /m)	
Geometry	Stem Back Face Vertical Rebar	6H13-100	S1	1217<1327	
Soil Parameters	Stem Back Face Lateral Distribution Rebar	3H10-140		500<561	
Analysis Settings	Stem Front Face Vertical Rebar	5H10-120	S1	625<654	
Design Settings	Stem Front Face Lateral Distribution Rebar	3H10-140		500<561	
Analysis	Base Plate Bottom Rebar	4H10-140	S2 & S3 & S4 & S5	474<561	
Analysis Summary	Base Plate Back Bottom Distribution Rebar	16H10-160		400<491	
Loads	Base Plate Front Bottom Distribution Rebar	8H10-160		400<491	
Total Failure	Base Plate Top Rebar	3H10-200	S2 & S3 & S4 & S5	388<393	
Design and Detailing	Base Plate Top Rebar	6H13-100	S2 & S3 & S4	1223<1327	
Design	Base Plate Back Top Distribution Rebar	19H10-140		500<561	
Stem	Base Plate Front Top Distribution Rebar	6H10-160		400<491	
Base Plate	Chair Bar	11H10			
Outputs	Tiebar	28H10			
Drawing & Report					

New Detailing interface allows easy visualization and edit of rebars interactively. Go to **Stem / Base Plate > Pick a Reinforcement > Edit number / diameter / spacing**

Retaining Wall				Wall Label: Retaining Wall -1	
Inputs	Rebar Description	Rebar	Section Analysis	Required/Provided (mm <sup>2</sup> /m)	
Geometry	Stem Back Face Vertical Rebar	6H13-100	S1	1217<1327	
Soil Parameters	Stem Back Face Lateral Distribution Rebar	3H10-140		500<561	
Analysis Settings	Stem Front Face Vertical Rebar	5H10-120	S1	625<654	
Design Settings	Stem Front Face Lateral Distribution Rebar	3H10-140		500<561	
Analysis	Base Plate Bottom Rebar	4H10-140	S2 & S3 & S4 & S5	474<561	
Analysis Summary	Base Plate Back Bottom Distribution Rebar	16H10-160		400<491	
Loads	Base Plate Front Bottom Distribution Rebar	8H10-160		400<491	
Total Failure	Base Plate Top Rebar	3H10-200	S2 & S3 & S4 & S5	388<393	
Design and Detailing	Base Plate Top Rebar	6H13-100	S2 & S3 & S4	1223<1327	
Design	Base Plate Back Top Distribution Rebar	19H10-140		500<561	
Stem	Base Plate Front Top Distribution Rebar	6H10-160		400<491	
Base Plate	Chair Bar	11H10			
Outputs	Tiebar	28H10			
Drawing & Report					

## New Options in Retaining Wall Stability Checks

New options are introduced to consider the weights of wall stem, base plate, and backfill in dynamic stability checks. You can access these settings in **Analysis Settings > Dynamic Effects of Self Weights**



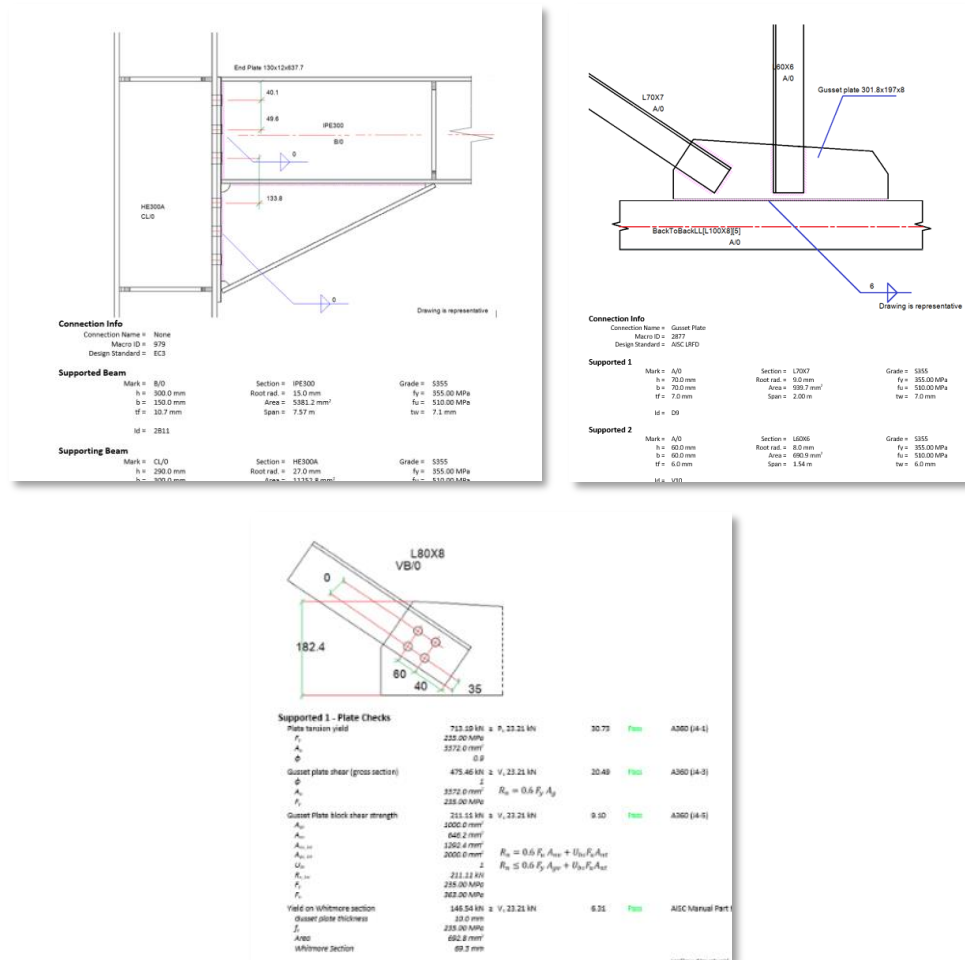
## ProtaSteel 2020

ProtaSteel 2020 redefines what's possible with automated connection design, steel work detailing and shop drawing production.

### New Connection Design Reports

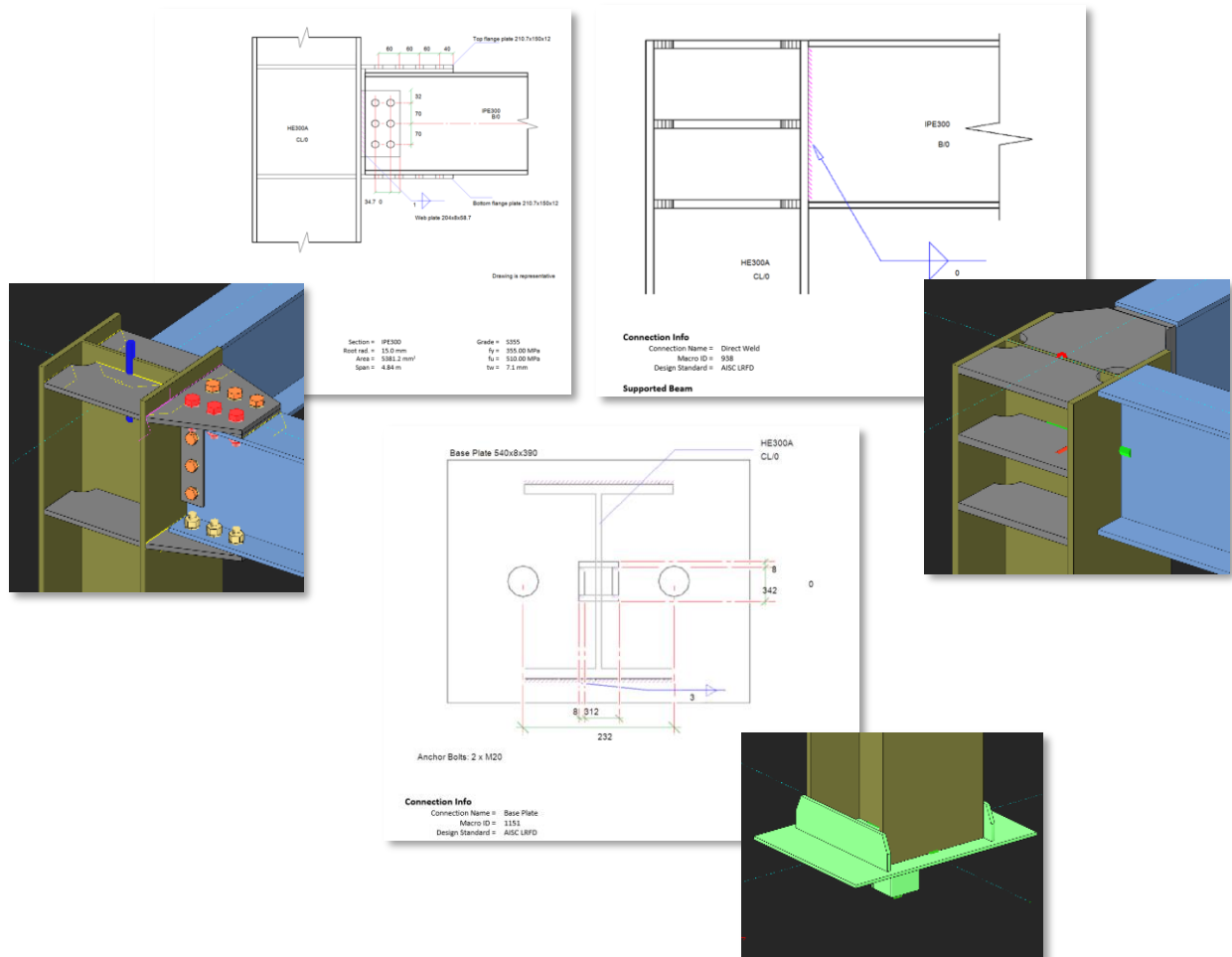
ProtaSteel 2020 introduces additional new connection design with comprehensive check reports to EC3, AISC (LRFD and ASD) and BS5950 with full code clause referencing including:

- Haunch Connection
- All bracing and truss connections:
  - Bolted Gusset Plate
  - Corner Bolted Gusset Plate
  - Welded Gusset Plate
  - Corner Welded Gusset Plate
- Purlin/Girt Connections
- Splice Connections
- Apex Haunch Connections



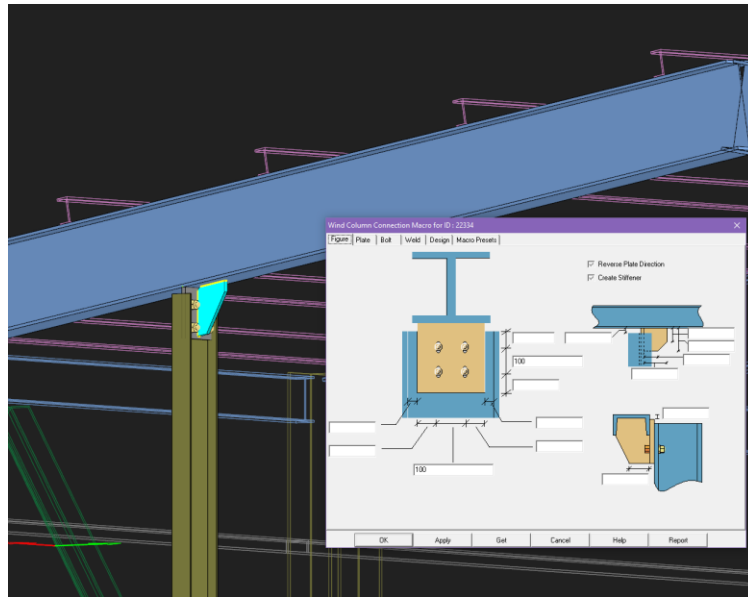
This adds to the extensive list of designed macros including;

- Fin Plate Connection
- End Plate Connection
- Stiffened End Plate Connection
- Flange-Plate Moment Connection
- Beam-Column welded connection
- Simple Base plate with stiffeners (Stiffeners can be inserted with the “Add Stiffener” option.)



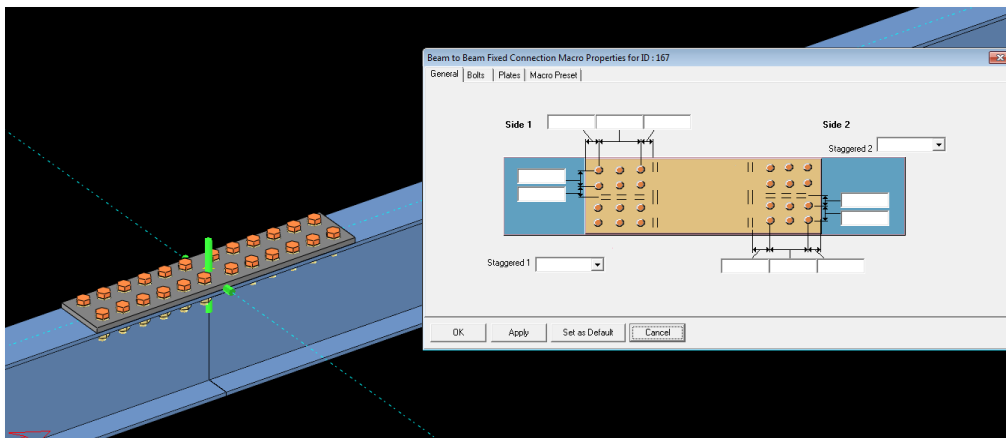
## New Macro: Wind Column Connection

Wind columns can now be connected to portal frame using Wind Column Connection macro.



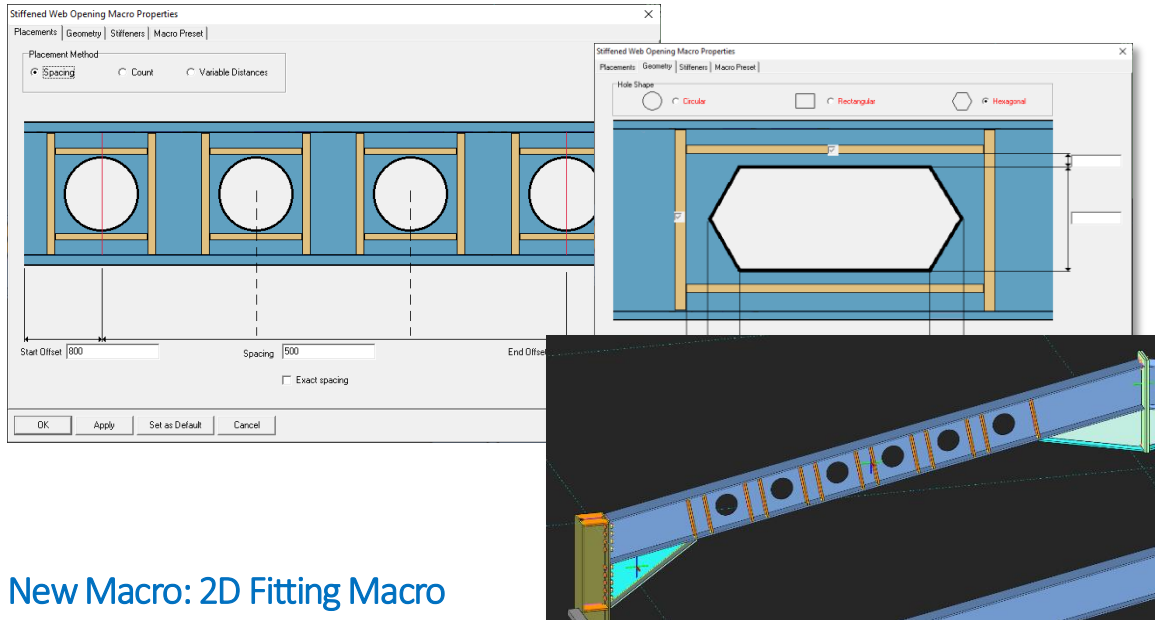
## New Macro: Beam to Beam Fix Connection

ProtaSteel 2020 introduces another frequently used connection type, especially for continuous beams. Two continuous beams are connected to the main girder with endplate or stiffened end plate connection. An additional top plate is used to ensure the moment fixity.



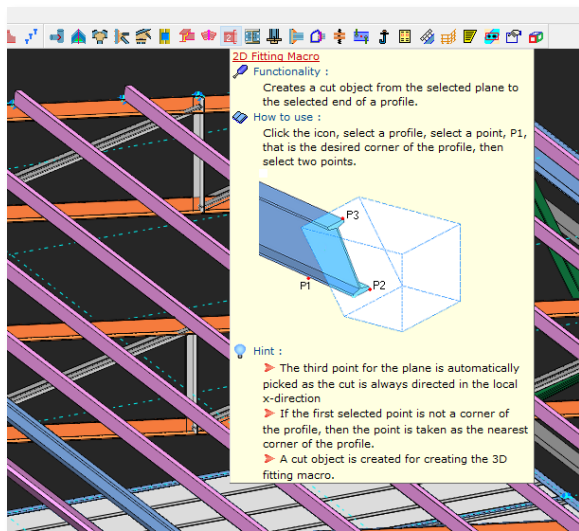
## New Macro: Castellated Beams and Beam Openings With Stiffeners

ProtaSteel now supports both castellated steel sections detailing and beam openings and any associated stiffeners. You can define a circular, hexagonal or rectangular opening or series of openings anywhere along the beam web. Optional stiffeners with flexible arrangements can be introduced.



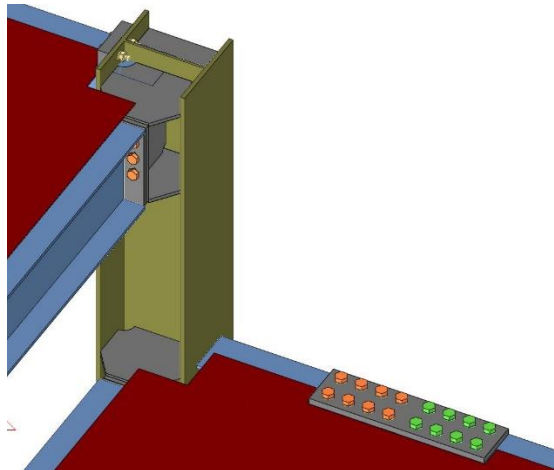
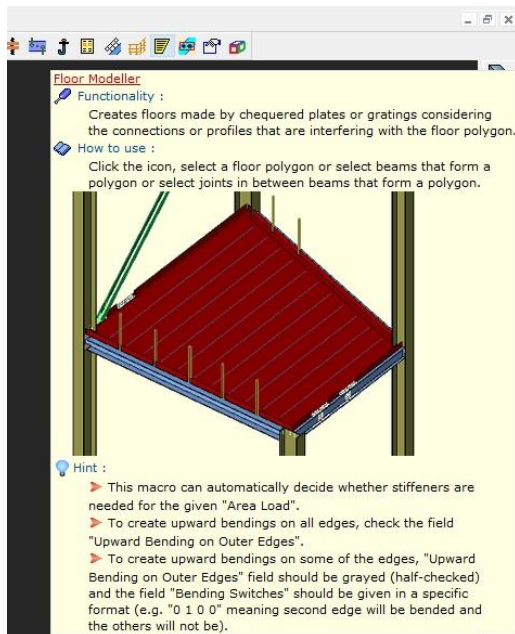
## New Macro: 2D Fitting Macro

2D Fitting macro creates a cut object from the selected plane to the selected end of a profile. For detailed information on this macro, please watch [https://www.youtube.com/watch?v=YYw7b\\_1RYPI](https://www.youtube.com/watch?v=YYw7b_1RYPI)



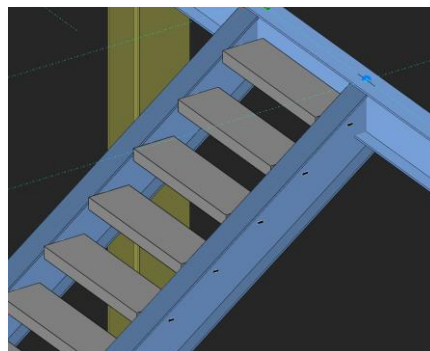
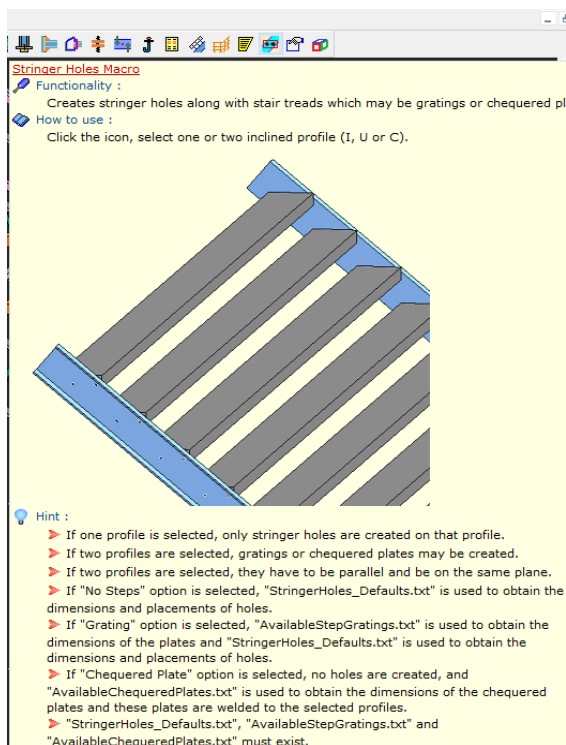
## New Macro: Chequered Plate and Grating

Chequered plate and grating can be now created in ProtaSteel. These can be included in material lists and detail drawings.



## New Macro: Automatic Stair Treads

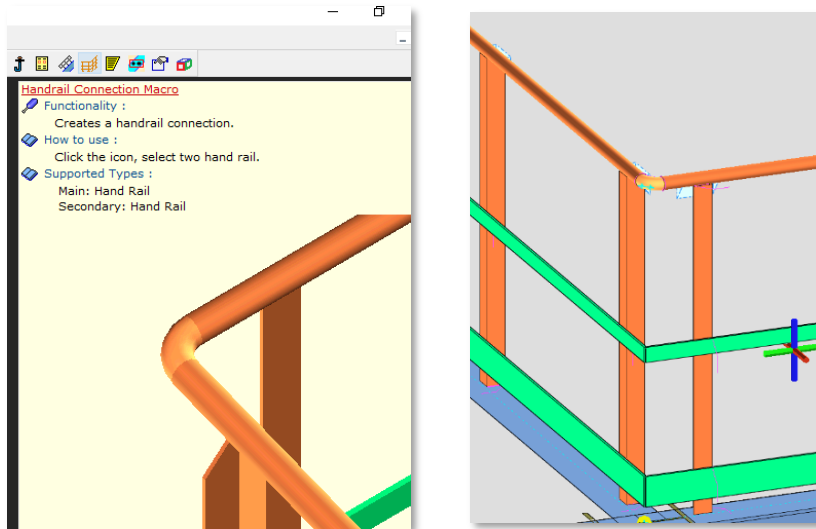
A new macro named **Stringer Holes Macro** is developed in order to be able to automatically create the step treads between I, U and C sectioned beams. This macro will open the step holes inside the selected profiles and create the steps.





## New Macro: Handrail Connection Macro

“Handrail Connection Macro” can be used to automatically weld two neighboring rails.



## New IntelliConnect Cases

IntelliConnect is now able to connect joints where:

- Steel beam frames into an RC beam
- Steel beam frames into an RC column
- Truss top chord to column connections
- Truss bottom chord to column connections
- Addition of Simple Base Plate Connection to Column Support IntelliConnect case

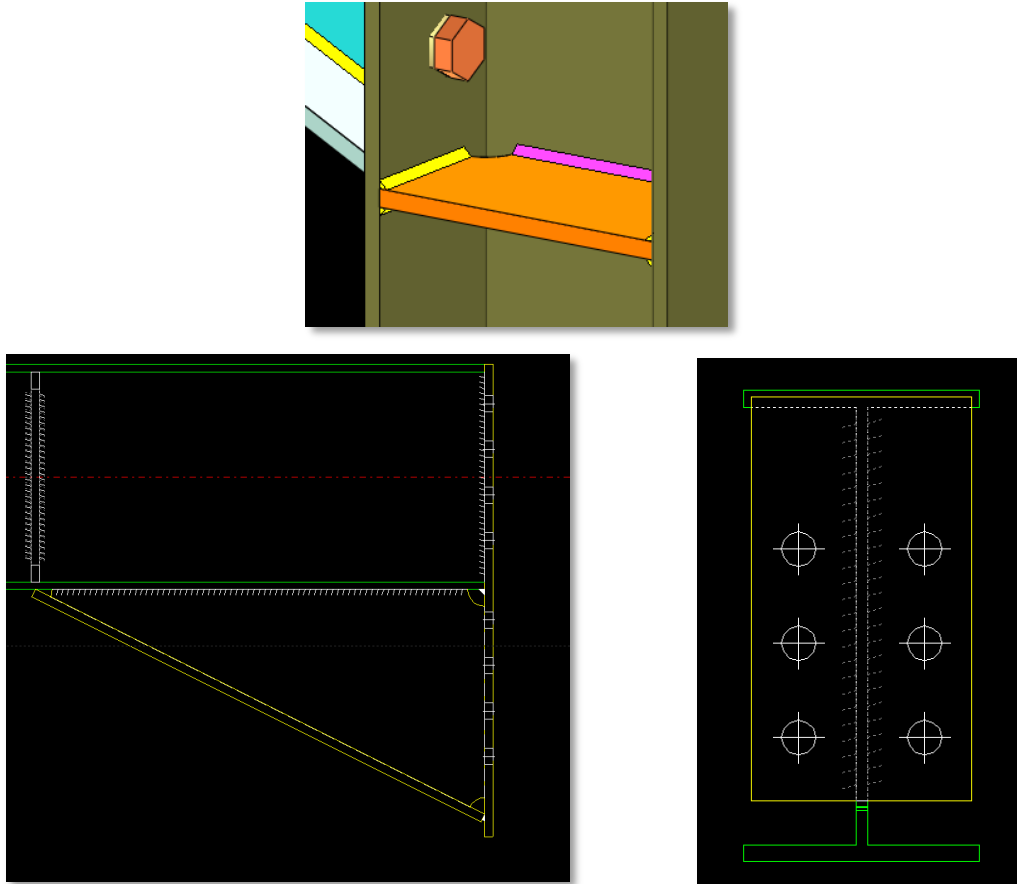
## Connection Grouping and Numbering

Connections can be grouped and annotated in drawing module.



## Improvement of Weld Drawings (3D Modeling and Hatching of Fillet Welds)

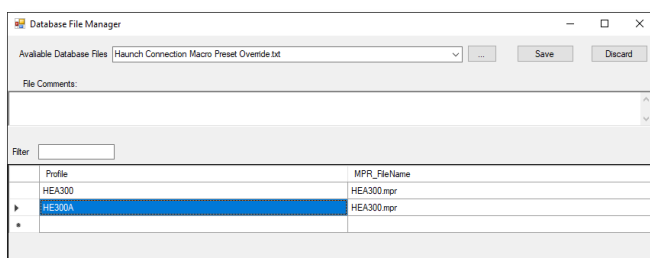
Fillet welds are now modelled as 3D objects in the model and this enables drawing of these welds to be hatched in shop drawings.



## Macro Preset Mapping

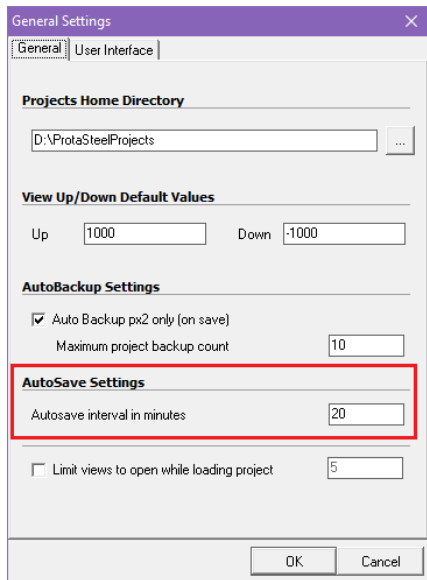
ProtaSteel now allows you to create macro presets for any connection or modeling macro using your favorite settings and company standards.

Creating presets is only half of the job. With ProtaSteel 2020, you can now map your preferred macro presets to distinct profile types. Creating a custom connection experience where you can dictate your connection preferences for any given sections. This powerful feature brings unparalleled productivity in connection design and standardization. Moreover, Intelliconnect also honors the preset maps you have specified.



## AutoSave

ProtaSteel 2020 supports an Auto Save option now. By default, model is saved in every 20 minutes and the auto saved model can be restored next time the user loads the model. Auto Save interval can be adjusted in General Settings Window (if the interval is set to "0", Auto Save is disabled).

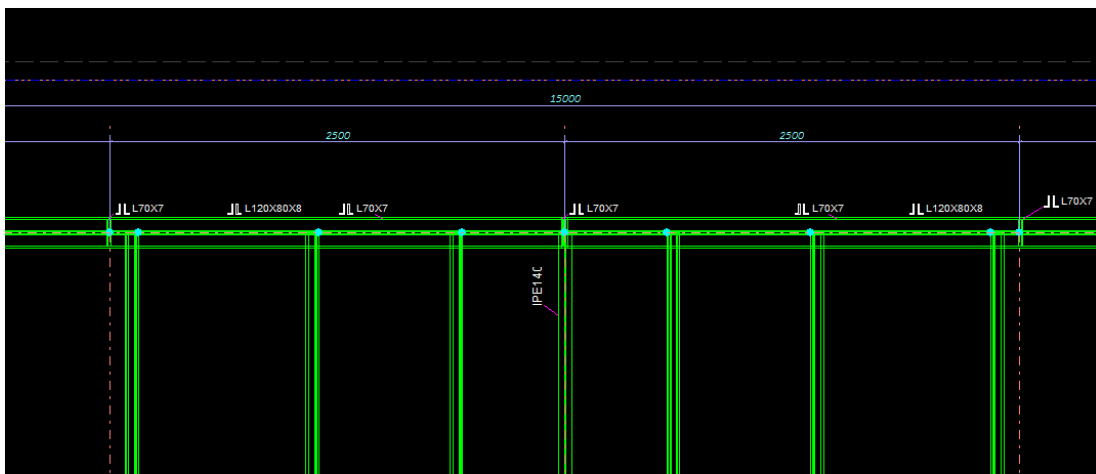


## ProtaStructure Frame Member End Forces Tables

Internal forces of a frame element for all load combinations obtained from analysis in ProtaStructure is now displayed in Frame Element Property Editor.

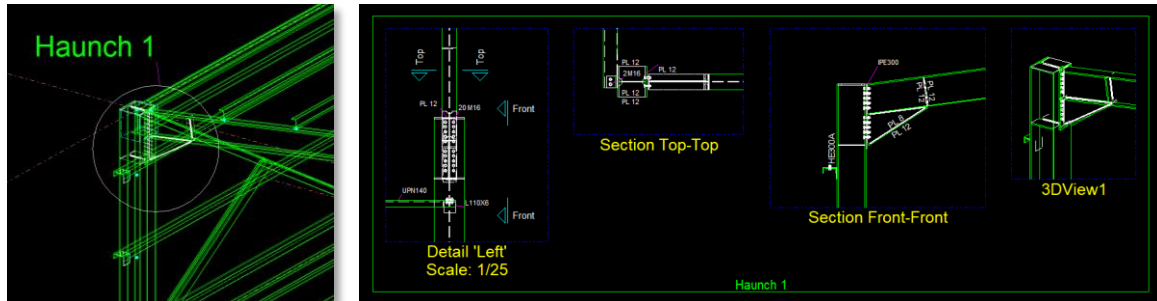
## Automated Dimensioning of Axes in General Arrangement Drawings

Floor plans which are automatically transferred from ProtaStructure are now automatically dimensioned in general arrangement drawings.



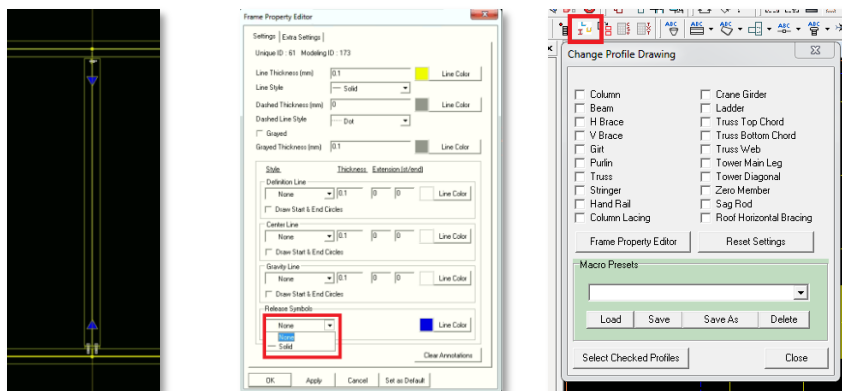
## Automated Leaders and Annotation of Connection Details

Typical connection details in general arrangement drawings are now automatically annotated, and a leader is automatically placed on the view.



## End Release Display in General Arrangement Drawings

Members with end releases can now be indicated in general arrangement drawings.



## Improvements in Sheet and Drawings Module

- Rotation functionality is introduced for Text and TextType2 objects.
- Coordinate system option is introduced for Regions
- Underline, and leaders are added to Generic Solid label text.
- Viewport names can now occupy 2 lines.
- Section marker is preserved when Section Symbol object is exploded.
- Drawing regions can now be copied.
- Weld hatching is optimized according to scale
- Drawing collapse feature is improved. Now; collapse gap can be set by the user, and drawing module objects (as opposed to model objects) can be excluded from collapse.
- Created regions were previously placed outside of the paper area. They are now placed automatically in a suitable position in paper area.
- It is now possible to automatically zoom fit to a parent region of a detail or section region via "Zoom to Parent View" button.
- TextWidth factor used in DXF export of drawings can now be adjusted via ini file settings.
- Drawing Document creation parameters are now controllable from DrawingModule.ini file.
- Several minor bug fixes.

## Bug Fixes and Improvements

During the course of ProtaStructure 2020 development, reported issues inherited from previous versions are fixed and significant improvements are made.

## Thank You

Thank you for choosing the ProtaStructure Suite product family.

At Prota it is our continual aim to provide you with user-friendly, industry-leading technology for building design and documentation

Should you have any technical support requests or questions, please do not hesitate to contact us at all times through [globalsupport@protasoftware.com](mailto:globalsupport@protasoftware.com) or [asiasupport@protasoftware.com](mailto:asiasupport@protasoftware.com) (Asia Pacific)

Our dedicated online support center together with our responsive technical support team is available to help you get the most out of Prota's technology solutions.

The Prota Team

