

# ProtaStructure® Suite

## Structural Technology to Accelerate Your Project Delivery

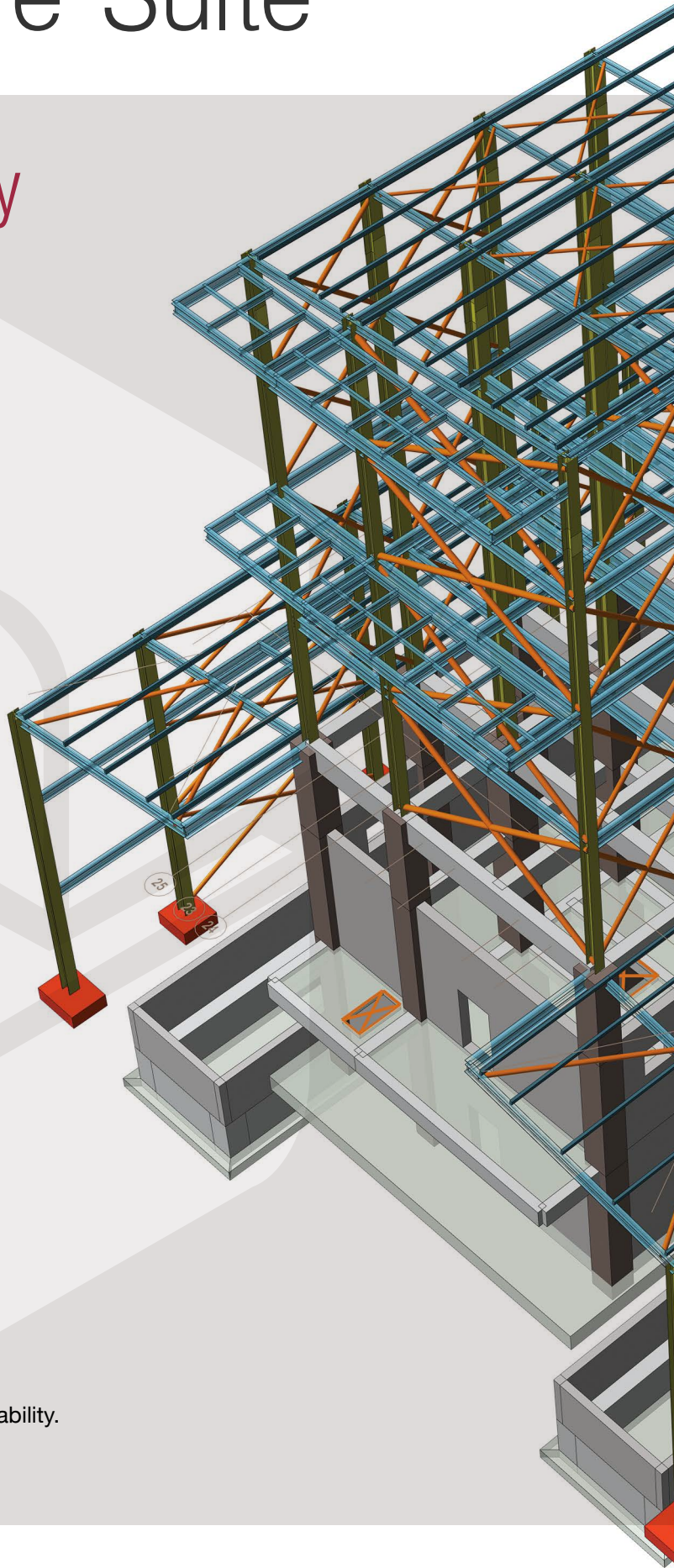
- Fast multi-material building modelling using physical structural members
- State-of-the-art structural analysis methods
- Economical and reliable design
- Fully automated engineering drawings and fabrication detailing
- Complete quantities take-off for costing and comparison
- Leading BIM Integration for project coordination

*ProtaStructure is an innovative BIM solution for structural engineers to model, analyze and design buildings quickly and accurately.*

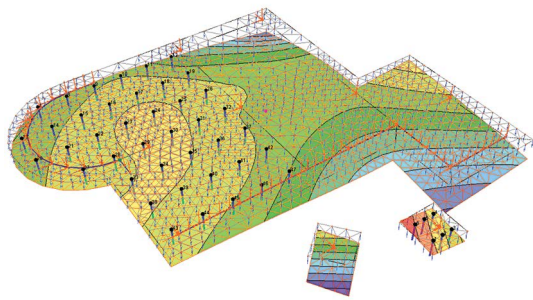
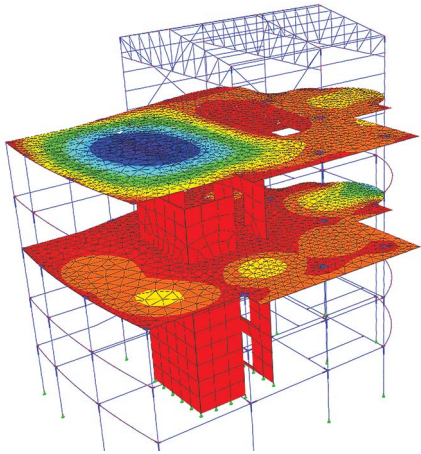
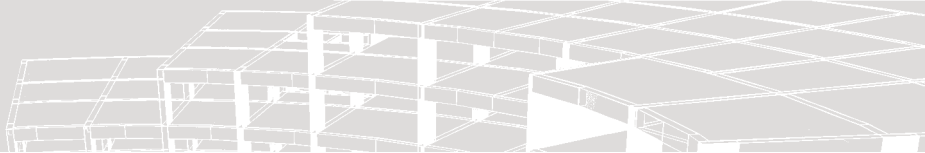
From one central model, easily compare different schemes and automate your steel and concrete design, significantly reducing project delivery time.

Produce high quality drawings and all design documentation from **ProtaStructure** automatically using **ProtaDetails** and **ProtaSteel**. Seamlessly coordinate projects with intelligent BIM integration.

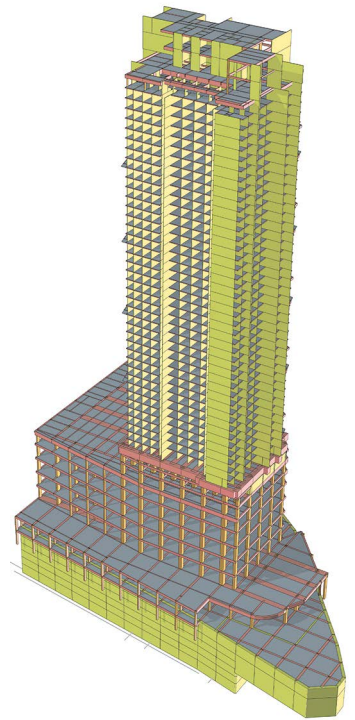
**ProtaStructure** saves time and increases business profitability.



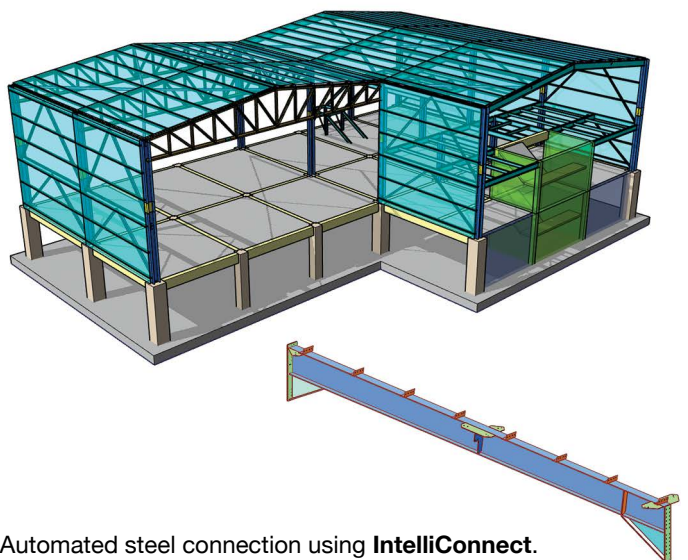
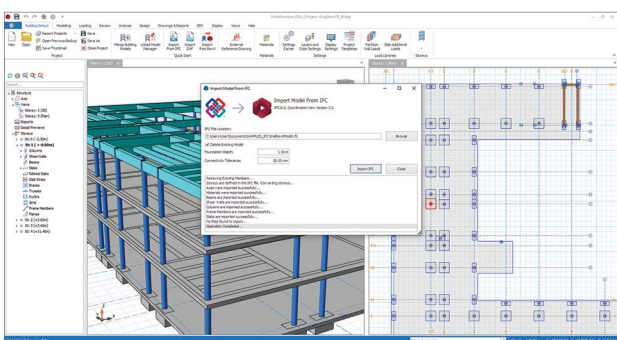
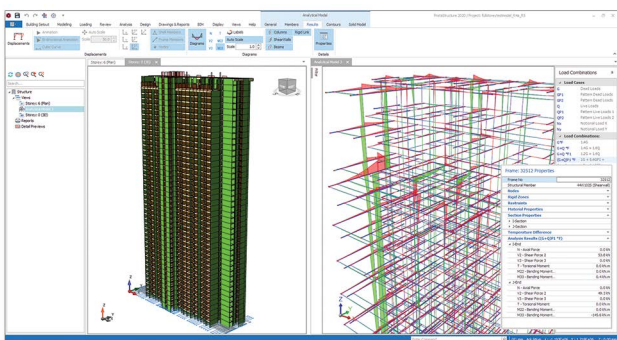
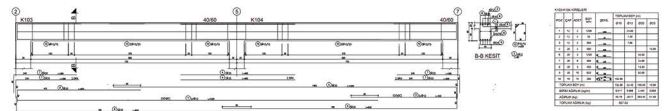
# At First Glance



- Fast project delivery with fully integrated Concrete and Steel design from one central structural BIM design model.
- **Easy, quick, and intuitive** physical modeling and review with **Multiple Model Views** and **Dynamic Input**.
- 64-bit Architecture and Enhanced Technology Platform.
- **3D finite element analysis** with **state-of-the-art analytical model** with extensive analysis options and shell element support for floors and shearwalls.
- **Advanced analysis** techniques including Linear Elastic Analysis, Equivalent Static Earthquake Load, Response Spectrum Analysis, Time-History, Pushover, Concurrent cracked and uncracked analysis, Staged Construction, P-Delta, Temperature Difference, and Seismic Basement and Isolator considerations.



- Design to a range of leading **international codes** including **specialist seismic requirements**.
- Seismic assessment methodologies for Performance Based Design or Retrofit of buildings using **Linear Elastic, Nonlinear Pushover** or **Time-History** analyses.
- Fully automated **RC detailing** into your drawing sheets. **Manual drafting** using smart rebars. Change management and dynamic quantity tables together with Fast engineering macros including **retaining wall, stair, pool, pile analysis, design** and detailing.
- Flexible unit systematics supporting **SI, Imperial** and **MKS** systems.



- Automated steel connection using **IntelliConnect**.
- Complete steelwork engineering drawings together with comprehensive **part numbering** and **shop detailing for fabrication**.
- **Industry leading BIM integration** for starting, coordinating and sharing models
- **Interactive user experience** with extensive in-product learning, contextual help, live updates and dedicated technical support from Professional Engineers.

# Why Prota Software?

Prota Software draws from over 35 years of excellence delivering structural software development globally and technical expertise as award winning international professional engineering and architectural consulting practice.



## Designed by Engineers for Engineers

Prota Software has a passion for engineering excellence and making the world a better place. Prota Software actively engages in technical research, presenting papers to numerous conferences and publications around the world and contributes to drafting codes of practice to share our extensive knowledge, especially in earthquake design. Prota Engineering, our professional consulting business, has completed projects in more than 30 countries around the world with a focus on large commercial and infrastructure projects including airports and metro-lines. We actively use BIM technology to deliver both conventional and design build projects where optimizing design and practical construction methodologies are critical to success. **ProtaStructure** is born out of a desire to share our knowledge and is shaped by our own inhouse experience together with our thousands of users around the world.



## Leading BIM Expertise

Open BIM collaboration and sharing knowledge is a core principal at Prota Software. It helped us deliver some of the world's most challenging infrastructure and transportation projects. **ProtaBIM** reinforces Prota Software's standing as a leading provider of advanced BIM technology with new bi-directional links with the latest versions of Revit, IFC, DXF, SAF and other recognized BIM and Analysis formats. Models can be synchronized and design changes tracked greatly enhancing your project coordination and workflow.



## Advanced Analysis Features

Prota Software develops its own focused analytic approaches important for building design, from basic static, dynamic and finite-elements analysis to advanced considerations including nonlinear static pushover, time-history, construction stage and P-Delta analyses, Prota Software has you covered.



## Code-Based Design Expertise

Prota Software's experience with delivering projects around the world coupled with close collaboration with users and industry experts means we understand structural design. At its core, **ProtaStructure** provides a sophisticated and flexible structural design engine allowing you to optimize your entire building from the roof to the foundations. All the detailed code-based checks are performed and documented to your chosen code of practice. A growing range of international and seismic codes of practice are supported including US, European, Indian and British Standards. Together with numerous, country specific, localisations.



## Friendly Professional Support That Engages

We strive to provide our users with great experiences using **ProtaStructure**. From our extensive online Prota Software Help Center to our in-product learning we aim to enrich your knowledge and provide practical, user friendly support. Our professional support engineers love engaging with our clients, whether its answering technical queries or providing hands-on training, we are here to help.

# Leading Structural BIM Collaboration

## > Structural BIM at Its Core

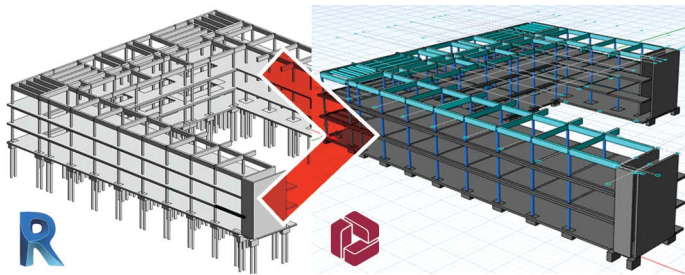
**ProtaStructure** is natively designed with structural BIM in mind. We use intelligent physical objects to drive modeling, design, coordination and documentation.

## Support for BIM Industry Standards

- > **ProtaStructure** supports both import and export of IFC, 2D/3D DXF and SAF files enabling professionals to share the models between **ProtaStructure** and other leading BIM platforms including Autodesk Revit, ArchiCAD, and AllPlan.

## > Bi-directional Integration with Autodesk Revit

Prota Software has developed bespoke integration with **Autodesk Revit** to facilitate direct, seamless model coordination, providing tools to roundtrip and **synchronize changes** as they occur. Explore revisions with **color-coded visualization** and interactive **change logs**. Take advantage of new family mapping functionality providing you with a tailored experience to suit your BIM work processes and standards.

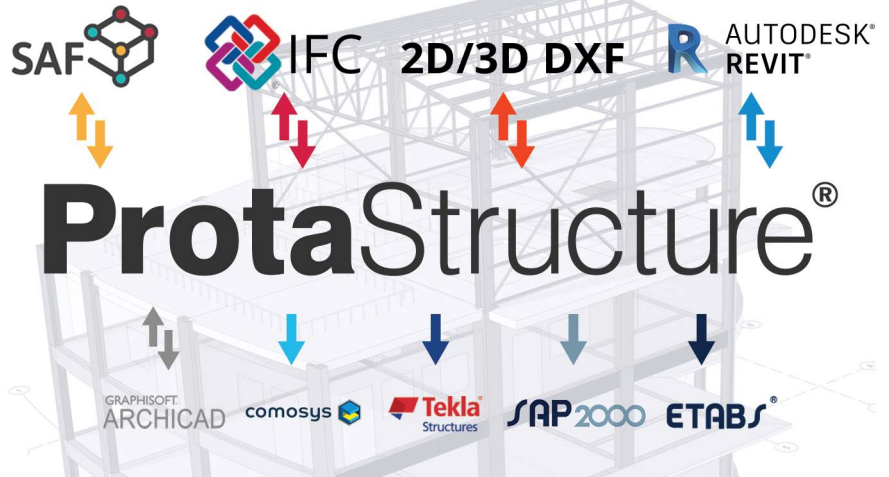
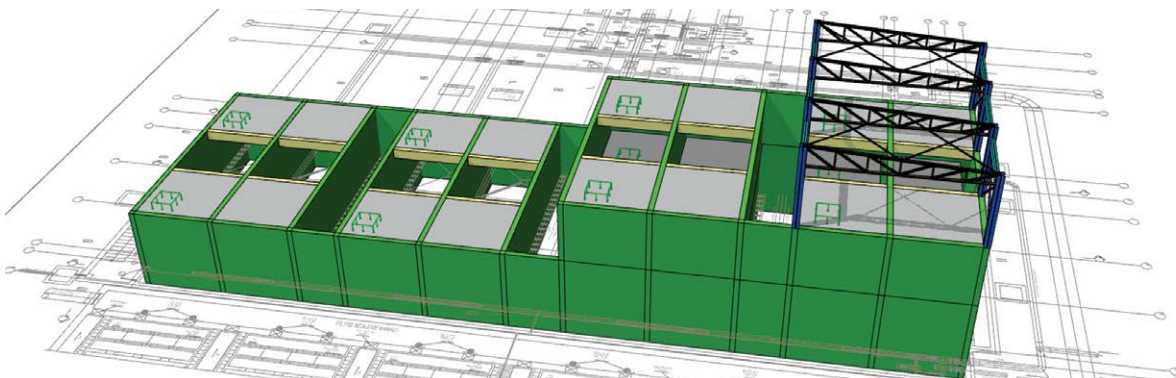


## > Analysis Model Collaboration

We understand that engineering offices use a range of different analysis and design tools to get the job done. Many firms and checking authorities also require structural engineers to cross-check and validate analysis results against other accepted platforms. **ProtaStructure** allows you to easily achieve this with **open intelligent model links** to OpenSees, ETABS™, SAP2000™, LUSAS™, SAF integration and more.

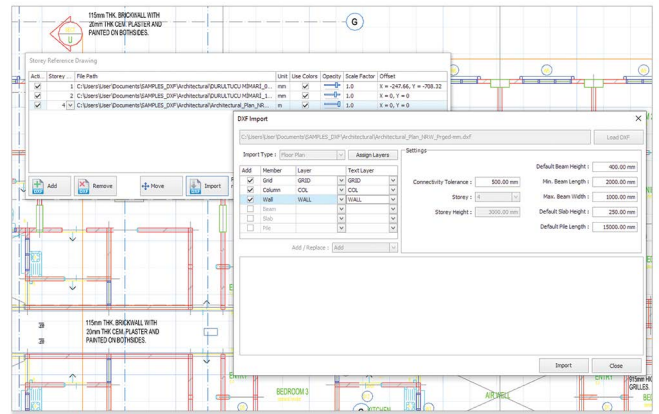
## > Output Reports and Drawings to Industry Standard Formats

- Create and share customizable and highly visual **calculation reports** featuring Microsoft Office and PDF export abilities.
- Detail drawings are fully compatible with industry standard **DXF and DWG formats**. All drawings in **ProtaStructure** follows best drafting practices and provide full layer, style and scaling flexibility.
- Bespoke templates customized to suit your **company drafting preferences** can also be easily established and re-used for any project. Additional formats including 3D DXF, STL and image files are also available.



## > Create Models from 2D and 3D Information

Modelling processes can even start with our DXF import where we can convert and **extrude drawings** into Physical **ProtaStructure** models. Line and face elements like column, beam, walls and slabs in 2D key plans and 3D DXF files can be quickly converted to 3D **ProtaStructure** models. Architectural drawings can be overlaid against structural floors to aid **coordination**.



• Autodesk Revit is a registered trademark of Autodesk, Inc.  
 • GRAPHISOFT, ArchiCAD is a registered trademark of GRAPHISOFT SE.

• Tekla Structures is a registered trademark of Trimble Solutions Corporation.  
 • SAP 2000 and ETABS are registered trademarks of Computers and Structures, Inc.

# Seismic Design and Analysis Capabilities

**ProtaStructure** provides engineers with comprehensive tools to design and detail buildings quickly and economically to meet rigorous earthquake standards including US and EC codes of practice.

## Wide Coverage of Seismic Codes

**ProtaStructure** supports a wide range of seismic codes including IBC, UBC, EC8, NSCP, SNI, Thai, Peruvian and Turkish standards.

## Seismic Parameters and Response Spectra

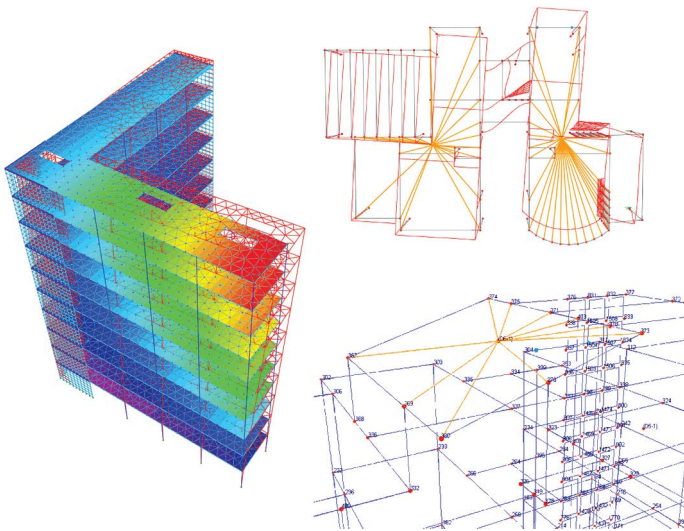
Elastic and design response spectra are calculated automatically using code-specified parameters. Site-specific spectra can also be introduced. Mass sources are automatically calculated including consideration of varied live load participation.

## Equivalent Static Earthquake Loads

Static earthquake loads are automatically calculated and applied at story levels. **Multiple diaphragms** and **accidental eccentricities** are taken into consideration.

## Diaphragm Modeling and Story Meshing

**ProtaStructure** has smart features for automatically detecting and defining intelligent rigid diaphragms. Multiple towers with discrete independent floors, discontinuous, stepping, sloping slabs and openings are all considered. Any floor can be selectively meshed and assigned as a flexible diaphragm.

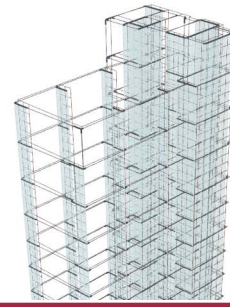


## Strong Column-Weak Beam Checks

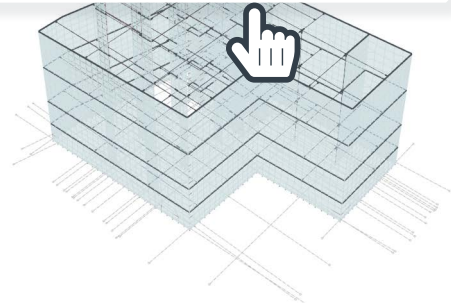
Tedious Strong Column-Weak Beam checks are automated at every joint. Joint checks are summated bi-directionally at every floor to ensure building collapse mechanisms perform in meeting accepted code provisions.

## Joint Shear Checks

Overlooking joint shear can potentially cause catastrophic failure of buildings during earthquake events. **ProtaStructure** automatically detects Confined or Unconfined joints and checks against brittle failure.



## Client Success



## Seismic Forces on Non-Structural Members

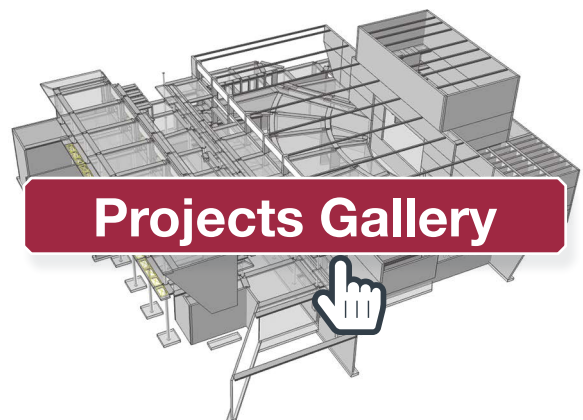
Forces acting on non-structural members and their connections to the building can be calculated to **ASCE07**, **Eurocode 8**, and **TBDY2018**. You just need to define the non-structural members and **ProtaStructure** will automatically calculate the story accelerations and forces depending on the analysis type.

## Seismic Separation of Buildings

To avoid pounding damage in adjacent buildings, a spacing must be provided between them. With the **Seismic Separation Design** tool, you can either load the displacements of an existing second **ProtaStructure** model or you can enter the displacement values of the second model manually. Calculations can be done to **ASCE07**, **Eurocode 8**, and **TBDY2018**.

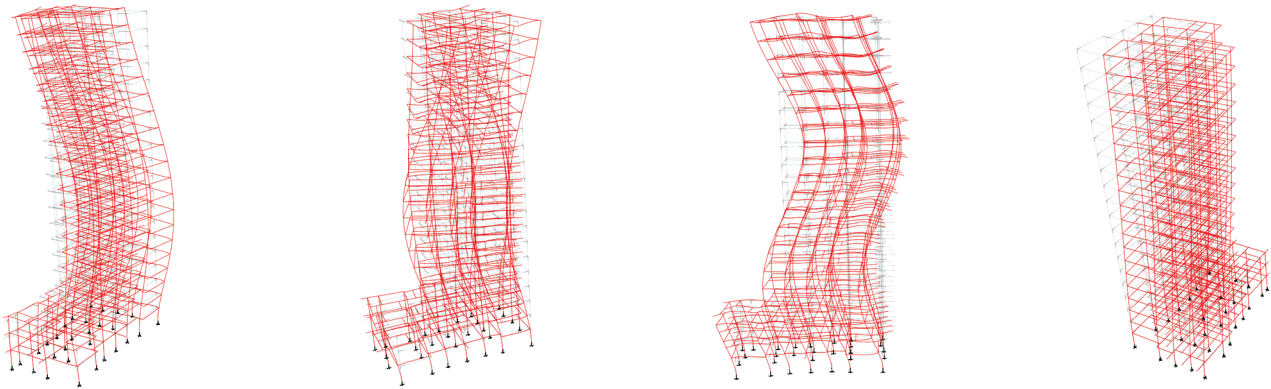
## Retrofitting and Assessment with CFRPs

**ProtaStructure** is capable of retrofitting and assessment of beam and column members confined with Carbon Fiber Reinforced Polymers (CFRPs). The CFRP confinement has a positive effect on shear resistance and axial load capacity of members. These effects can be considered according to the TBDY2018 seismic code. CFRP definition can be assigned to the members using the "Retrofit Using FRP" command on the right-click menu or contextual ribbon tab of the member.



## Projects Gallery

# Seismic Design and Analysis Capabilities



## Response Spectrum Analysis

Mode superposition analysis can be used where static approach is not applicable. Modal results are combined with CQC. RSA base shear is automatically scaled to Equivalent Static results. Cumulative mass participation of modes is automatically calculated.

## Consider Cracked and Uncracked Sections in One Analysis Run

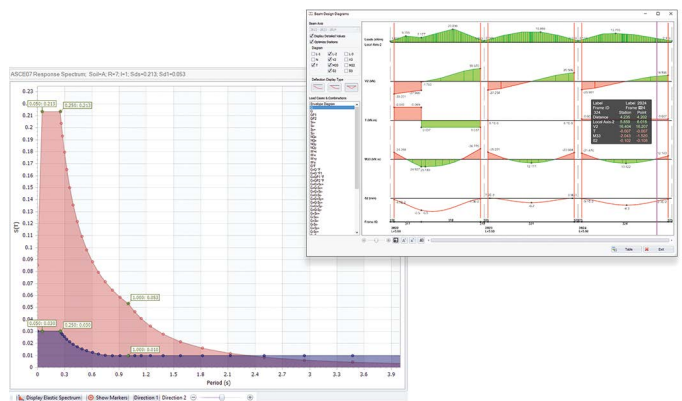
Cracked and uncracked section properties can be simultaneously used in the same analysis for different load cases. Code modification defaults can be automatically applied to section properties.

## Two Stage Analysis for Upper and Lower Structure

An automated two stage analysis is performed in one-go for buildings with rigid basements. Different mass sources for upper and lower structure are automatically considered.

## Vertical and Horizontal Irregularities

ProtaStructure has powerful features to assess building irregularities in accordance with earthquake code requirements. Floor Torsion, Diaphragm Discontinuity, Mass, Stiffness, Weak Storey and Non-parallel system irregularities are all checked, and any required penalties are applied.



## Nonlinear Static Pushover

- Single Mode Static Pushover analysis is performed using ProtaStructure - OpenSees integration. 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 afterwards.

TORSION IRREGULARITY CHECK:				
Open	Minimum Absolute Storey Drift			
Close	Maximum Absolute Storey Drift			
Δ	Relative Storey Drift (Roofstorey - Roofstorey)			
Δ <sub>max</sub> / Δ <sub>ave</sub>				
EARTHQUAKE DIRECTION: 1 (Angle From X 0.00 Deg)				
Load Case: Ex* (Equip. Static Seismic X (E*))				
Storey	Δ <sub>max</sub> (mm)	Δ <sub>ave</sub> (mm)	Δ <sub>max</sub> / Δ <sub>ave</sub>	Δ <sub>max</sub> / Δ <sub>ave</sub> (mm)
Storey 6	0.000958	0.001172	0.000982	0
Storey 5	0.000795	0.000935	0.000226	0
Storey 4	0.000959	0.000980	0.000209	0
Storey 3	0.000950	0.000423	0.000187	0
Storey 2	0.000161	0.000164	0.000156	0
Storey 1	0.000005	0.000044	0.0	0

INTERSTOREY STRENGTH IRREGULARITY CHECK (Weak Storey)						
Earthquake Direction: 1 (Angle From X 0.00 Deg)						
Storey	No	A-Column (mm)	A-Wall (mm)	A-Total (mm)	A-Part Wall (mm)	%
Storey 6	2	9750	9750	19500	0.0000	0.0000
Storey 5	4	11700	11700	18360	0.0000	1.913 ± 0.80
Storey 4	4	11700	11700	18360	0.0000	1.902 ± 0.80
Storey 3	4	11700	11700	18360	0.0000	1.000 ± 0.80
Storey 2	4	11700	11700	18360	0.0000	1.000 ± 0.80
Storey 1	4	26450	26450	26450	0.0000	2.266 ± 0.80

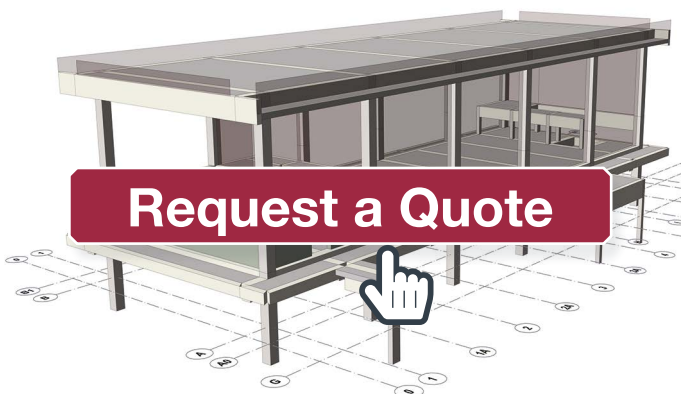
INTERSTOREY STIFFNESS IRREGULARITY CHECK (Soft Storey):						
Earthquake Direction: 1 (Angle From X 0.00 Deg)						
Storey	h (m)	Δ <sub>max</sub> (mm)	Δ <sub>ave</sub> (mm)	Δ <sub>max</sub> / Δ <sub>ave</sub>	Upper Storey Ratio	Upper 3 Storeys Ratio
Storey 6	3100	0.000192	0.000238	0.000915	0.000095	0.932 ± 0.70
Storey 5	3100	0.000261	0.000262	0.000251	0.000014	0.957 ± 0.80
Storey 4	3100	0.000209	0.000227	0.000233	0.000075	1.062 ± 0.80
Storey 3	3100	0.000197	0.000211	0.000204	0.000067	1.105 ± 0.70
Storey 2	3100	0.000148	0.000165	0.000197	0.000051	1.334 ± 0.70

## Seismic Isolators

Seismic isolators can be inserted anywhere on the structure for different seismic isolation scenarios. Both upper and lower structure design can be performed in ProtaStructure using target earthquake spectra. Drift of the structure and isolator displacements are also reported as a part of the design.

## Nonlinear Fiber Analysis of Sections

- Column, beam, and Wall sections can be modeled with fiber elements using distributed plasticity and analyzed with state-of-the-art numerical techniques to derive the Moment-Curvature relationships.
- Force-deformation relationships for integration points are obtained from detailed fiber section analysis.



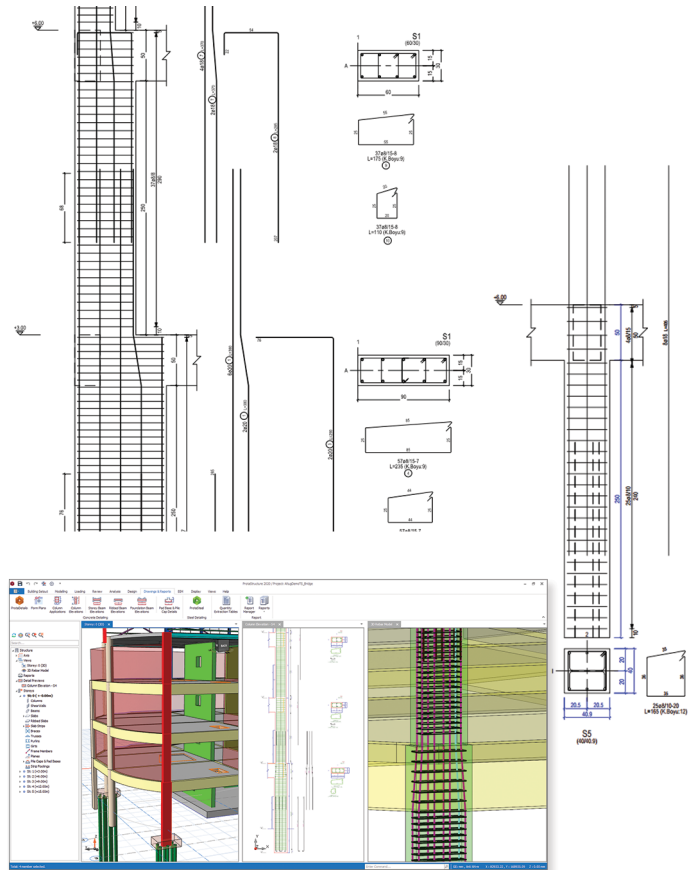
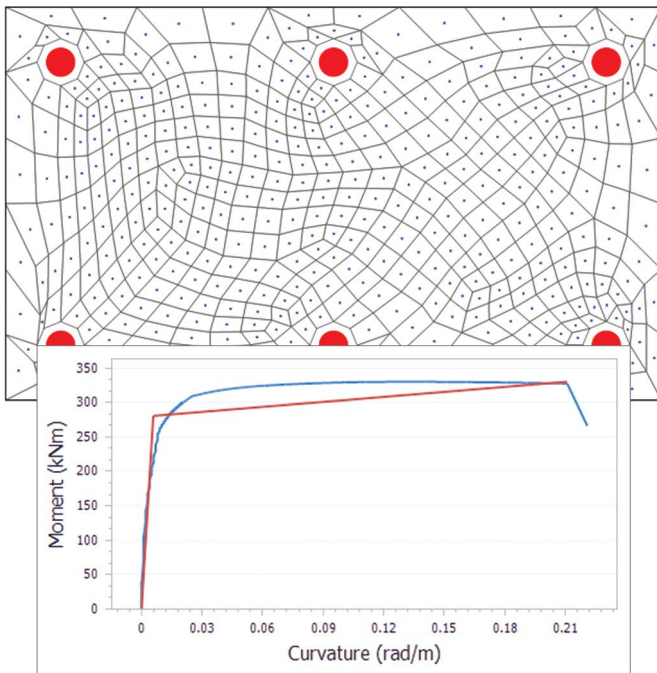
# Seismic Analysis and Design Capabilities

## Ductile Member Design and Detailing

Columns, walls, and beams are designed to special ductility requirements. Automated confinement of beam and column critical sections, wall end zones (boundary elements), wall design envelope, capacity shear design and much more are automatically considered.

## Diaphragm Integrity and Load Transfer Checks

Transfer of inertia loads between slabs and lateral load resisting members including shearwalls and collector beams is automatically verified. For flexible diaphragms, in-plane shear, tension and compression stresses are checked to prevent diaphragm failure.



## ProtaStructure for Performance-Based Design and Building Assessment

Prota provides unique tools for engineers to carry out performance-based building assessment.

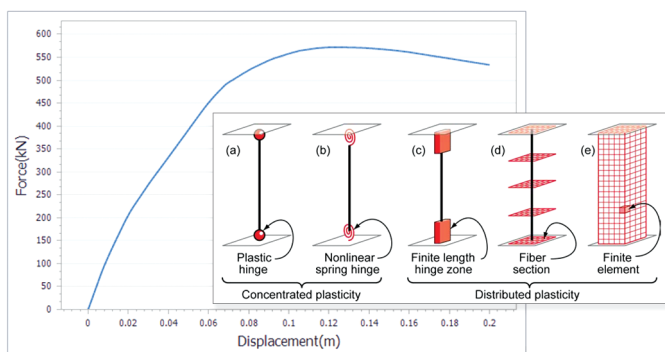
### Performance Goal: Controlled Damage - Earthquake Level: DD2 Assessment Report

Performance Assessment Report

Earthquake Level	Performance Goal	Direction	Most Critical Storey	Determined Building Performance Level	Status
DD2	Controlled Damage	X	2	Collapse Prevention	X

Earthquake Level: DD2 - Performance Goals are not Satisfied X

### Pushover Curve



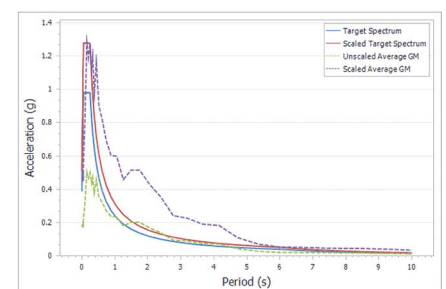
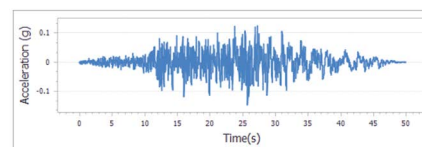
## Wall Coupling Beams

Special attention is provided for coupling beams. Different cracked section properties can be defined. The wall-beams assembly is checked for coupled wall effectiveness.

## Nonlinear Time-History Analysis

- Nonlinear Time-History analysis can be performed using **ProtaStructure - OpenSees integration**.
- User selected multiple ground motions can be applied simultaneously in X and Y directions. Ground motion application direction is rotated by 90 degrees, and analyses are repeated.
- Ground motion records are automatically scaled by **ProtaStructure** to your design requirements using the **simple scaling method** between 0.2T and 1.5T.
- Analysis results from multiple ground motion sets are automatically post-processed. The average values of absolute maximum responses are extracted and used to prepare detailed performance assessment reports.

GM1\_Z1\_Landers\_1992



### Time History Parameters

Analysis Label	Ground Motion Label	Label of Ground Motion in X-Direction	Label of Ground Motion in Y-Direction	Scale Factor	Total Duration	Analysis Time Step
GM1_Z1_Landers_1992_X	GM1_Z1_Landers	Z1_Landers_1992_ABY090	Z1_Landers_1992_BAK140	2.55	49.98	0.02

# Design Codes



Structural engineers around the world like to employ their own local approaches to both design and detailing. At Prota Software we understand this which is why we offer both a broad range of leading international codes as well as provide specific customization to suit your local requirements.

## Reinforced Concrete Design Codes

Code Name/Abbreviation	Country
ACI318-08	United States
ACI318-11	United States
ACI318-14	United States
BS8110-97	United Kingdom
CP65	Singapore
HK2004	Hong Kong
TS500-2000	Turkey
NTE *	Peru
SNI *	Indonesia
NSCP *	Philippines
Eurocode 2 Base Code	Europe
Eurocode 2 (UK)	United Kingdom
Eurocode 2 (IR)	Ireland
Eurocode 2 (PL)	Poland
Eurocode 2 (SG)	Singapore
Eurocode 2 (ML)	Malaysia

\* Only RC beam design is supported at the moment

## Loading and Wind Codes

Code Name/Abbreviation	Country
ASCE07-10	United States
BS6399	United Kingdom
TS498	Turkey
MS 1553	Malaysia
DPT 1311-50	Thailand
NSCP 2015	Philippines
NSR-10	Colombia
NTE.020	Peru
Eurocode 1 Base Code	Europe
Eurocode 1 (UK)	United Kingdom
Eurocode 1 (IR)	Ireland
Eurocode 1 (PL)	Poland
Eurocode 1 (RO)	Romania
Eurocode 1 (SG)	Singapore
Eurocode 1 (ML)	Malaysia

## Steel Design Codes

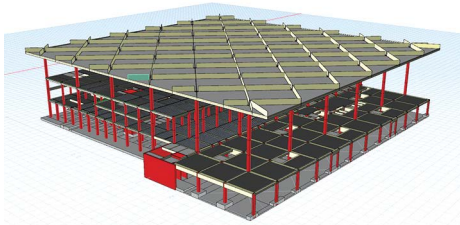
Code Name/Abbreviation	Country
AISC360-10 (LRFD, ASD)	United States
BS5950	United Kingdom
Eurocode 3 Base Code	Europe
Eurocode 3 (UK)	United Kingdom
Eurocode 3 (PL)	Poland
Eurocode 3 (SG)	Singapore
Eurocode 3 (ML)	Malaysia
TSC 2016 (LRFD, ASD)	Turkey

## Seismic Codes

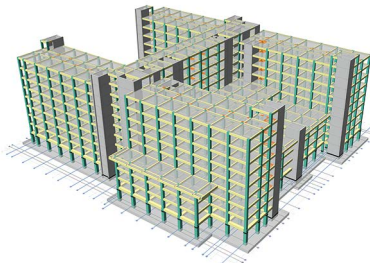
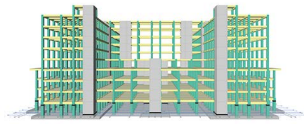
Code Name/Abbreviation	Country
IBC 2018	United States
UBC 97	United States
SNI1726-19	Indonesia
NSCP2015	Philippines
DPT1301/1302-61	Thailand
TDY 2007	Turkey
TBDY2018	Turkey
EC8 & P100	Romania
NTE.030	Peru
Eurocode 8 (ML)	Malaysia
Eurocode 8 (SG)	Singapore



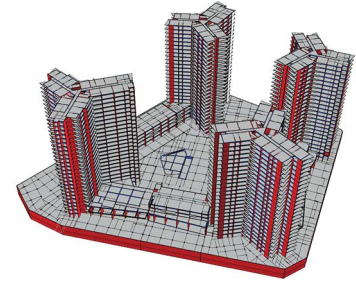
# Project References



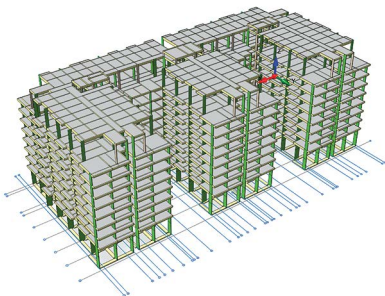
**Istanbul New Airport**  
*Prefabricated Slabs*  
 Total Area: 1.500.000 sq. meters



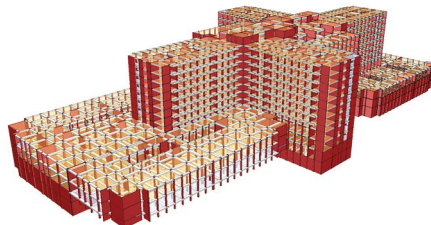
**Bartın Public Hospital**  
*Seismically Isolated Building*  
 Total Area: 52.000 sq. meters



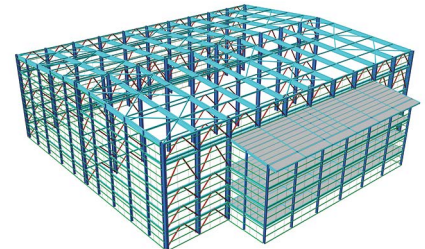
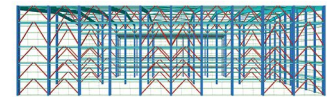
**AİSancak Residences**  
*High-Rise Concrete Building*  
 Total Area: 110.000 sq. meters



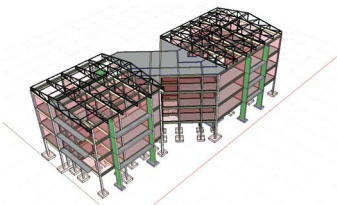
**Thu Thiem 2HA Residences**  
*Cast-In-Place Concrete Load-Bearing System*  
 Total Area: 20.000 sq. meters



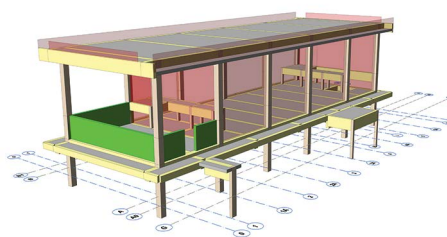
**Marmara Basibuyuk Research Hospital**  
*Retrofit and Assessment with Seismic Isolators*  
*(Existing columns and walls are cut in place)*  
 Total Area: 112.400 sq. meters



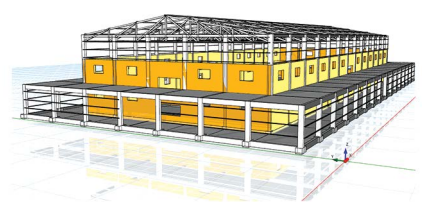
**Yacht Maintenance Facilities**  
*Steel Moment Resisting Frames*  
 Total Area: 22.000 sq. meters



**General Medical Laboratory**  
*Reinforced Concrete Frames with Shearwalls*  
 Total Area: 780 sq. meters

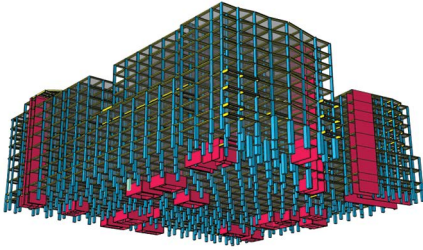


**Chemical Facility**  
*Reinforced Concrete Moment Resisting Frames*  
 Total Area: 33.000 sq. meters



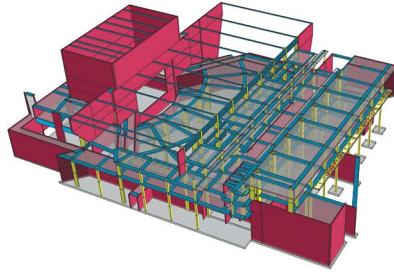
**Women and Children Development Initiative Foundation Center**  
*RC Structure with Steel Truss Roof System*  
 Total Area: 20.000 sq. meters

# Project References



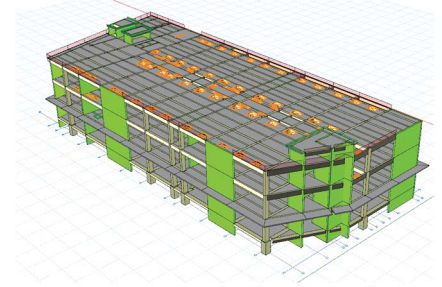
## Capa & Cerrahpasa Healthcare Campus

Cast-In-Place Concrete Frame Structure  
Total Area: 1.000.000 sq. meters



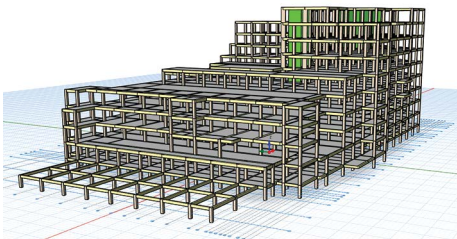
## TED College School Building

Cast-In-Place Concrete Frame Structure  
Total Area: 141.000 sq. meters



## Turkcell Data Center

Cast-In-Place Concrete Load-Bearing System  
Total Area: 15.000 sq. meters



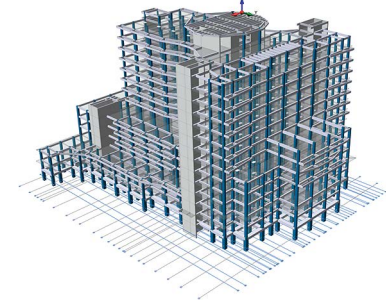
## Serdang Cardiology Hospital

Cast-In-Place Concrete Frame Structure  
Total Area: 30.000 sq. meters



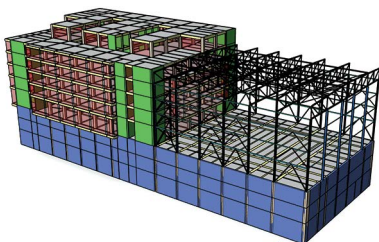
## High Rise Residential Kuala Lumpur

High-Rise Concrete Building  
Total Area: 65.000 sq. meters



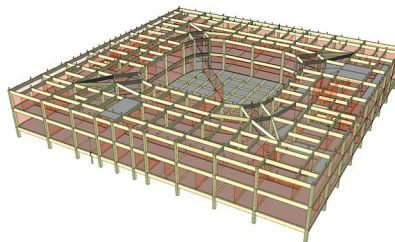
## Malatya State Hospital

Seismically Isolated Building  
Total Area: 52.300 sq. meters



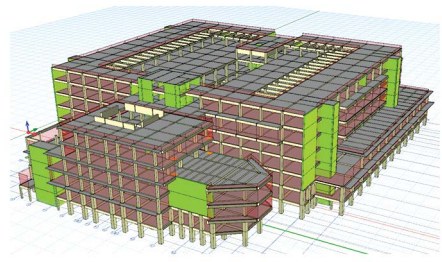
## THY Maintenance Repair Overhaul Facilities

Composite Hangar with RC and Steel Members  
Total Area: 431.143 sq. meters



## Auditorium Malaysia

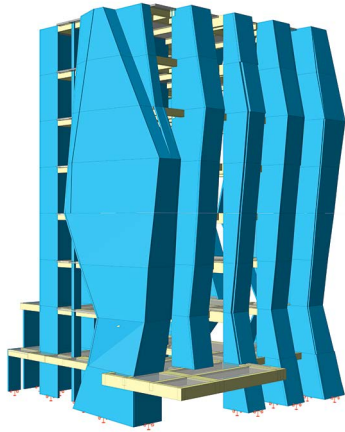
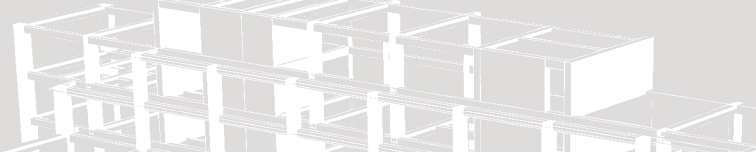
RC Structure with Steel Roof System  
Total Area: 17.000 sq. meters



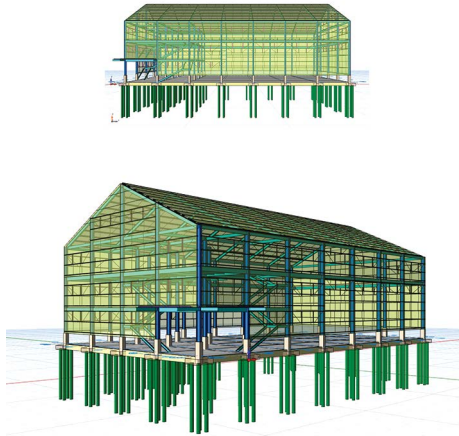
## Manisa Merkez Efendi State Hospital

Seismically Isolated Building  
Total Area: 115.000 sq. meters

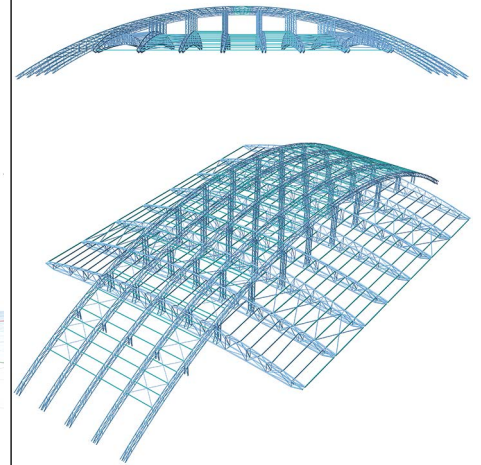
# Project References



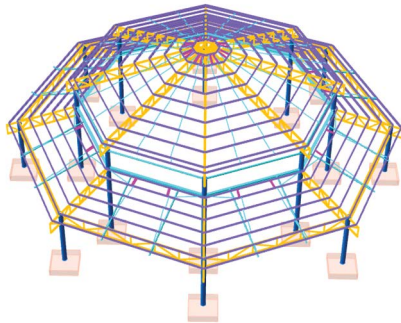
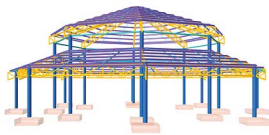
**Raid Tower**  
*High-Rise Residential Concrete Building*  
 Total Area: 5000 sq. meters



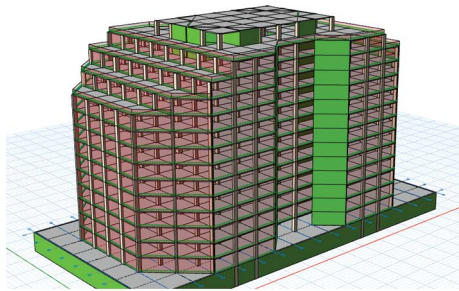
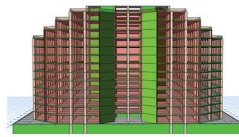
**Laboratorium Kalibrasi  
 Metrologi DKI Jakarta**  
*Steel Moment Resisting Frames*  
 Total Area: 1075 sq. meters



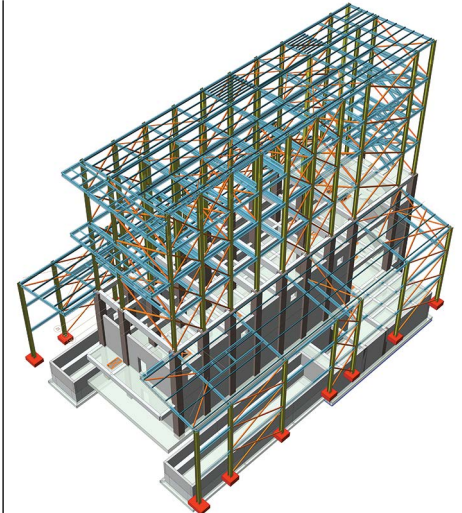
**Chekka Municipal Stadium Roof**  
*Steel Construction Roof System*  
 Total Area: 5000 sq. meters



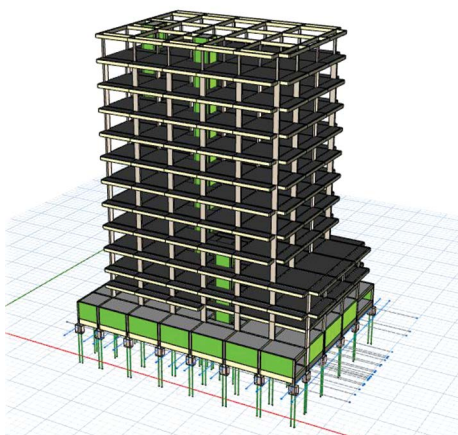
**Playground Roof**  
*Steel Construction Roof System*  
 Total Area: 433 sq. meters



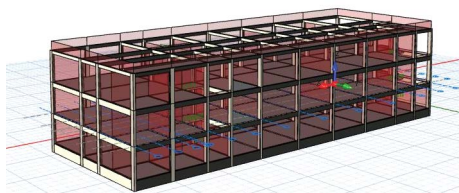
**Hexagon Ankara**  
*High-Rise Concrete Building*  
 Number of Floors: 13-storey



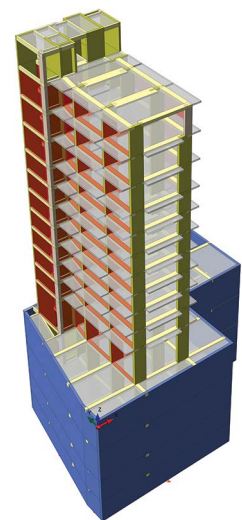
**1,000 Tons Capacity RC + Steel Facility**  
*RC & Steel Industrial Building*  
 Total Area: 2500 sq. meters



**Sky Heights Residential Complex**  
*High-Rise Residential Concrete Building*  
 Number of Floors: 12-storey

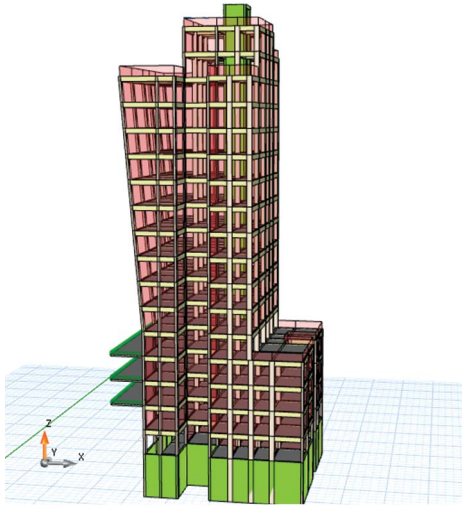


**Rio Grande Shopping Complex**  
*Cast-In-Place Concrete Frame Structure*  
 Total Area: 605 sq. meters



**Yapi Akademisi Hotel Building**  
*High-Rise Concrete Building*  
 Number of Floors: 10-storey

# Project References



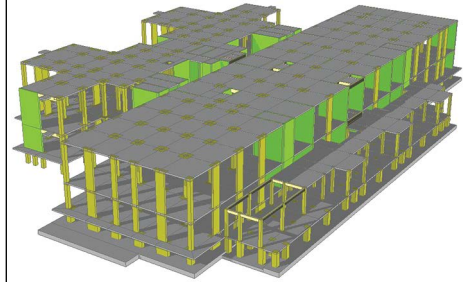
## CCECC Office Complex

High-Rise Concrete Building  
Number of Floors: 19-storey



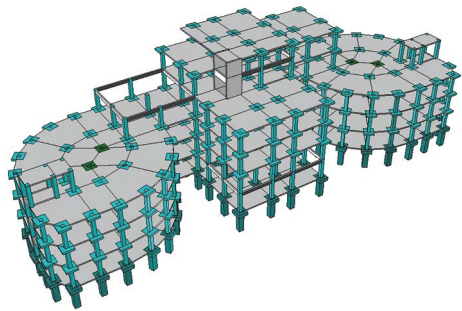
## Majucita Office Tower

High-Rise Concrete Building  
Total Area: 32.000 sq. meters



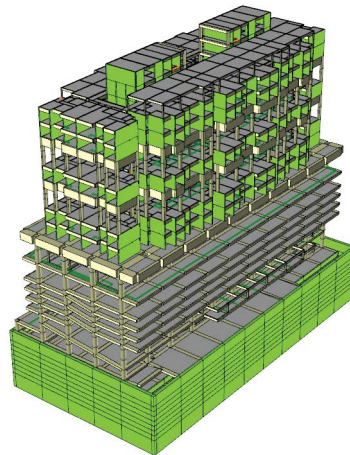
## Mugla Milas Hospital

Seismically Isolated Building  
Total Area: 32.743 sq. meters



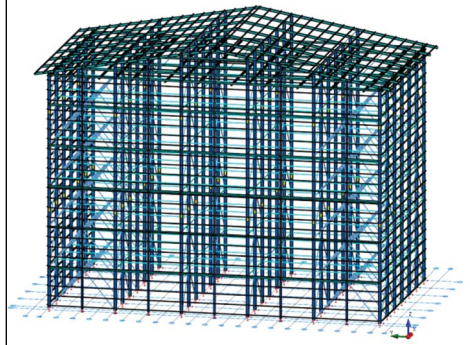
## Tokat Erbaa State Hospital

Seismically Isolated Building  
Total Area: 28.654 sq. meters



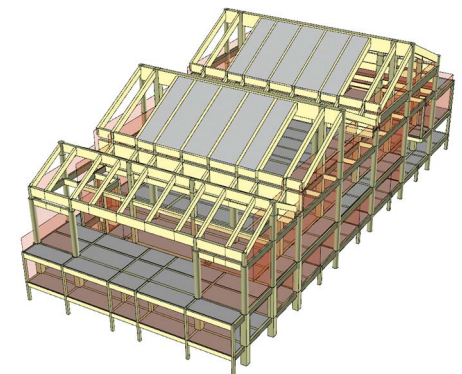
## Rizal Hood Multi-Purpose Building

Multi-Purpose Concrete Building  
Total Area: 34.000 sq. meters



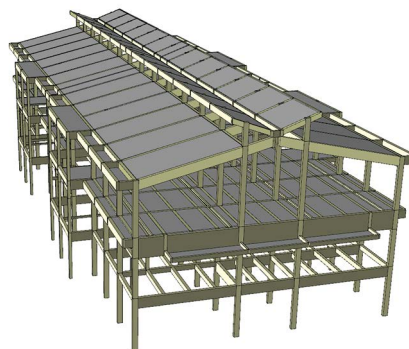
## Industrial Structure

Braced Frames  
Total Area: 960 sq. meters



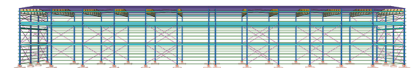
## LYS Complex

Concrete Frame Structure  
Total Area: 26.000 sq. meters



## MPA Public Building

Cast-In-Place Concrete Frame Structure  
Total Area: 18.000 sq. meters



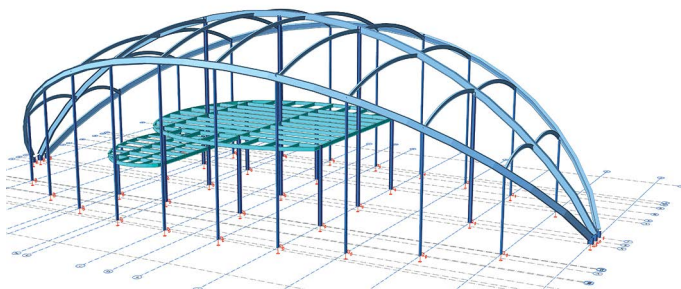
## Steel Hangar Building

Braced Frames  
Total Area: 1320 sq. meters

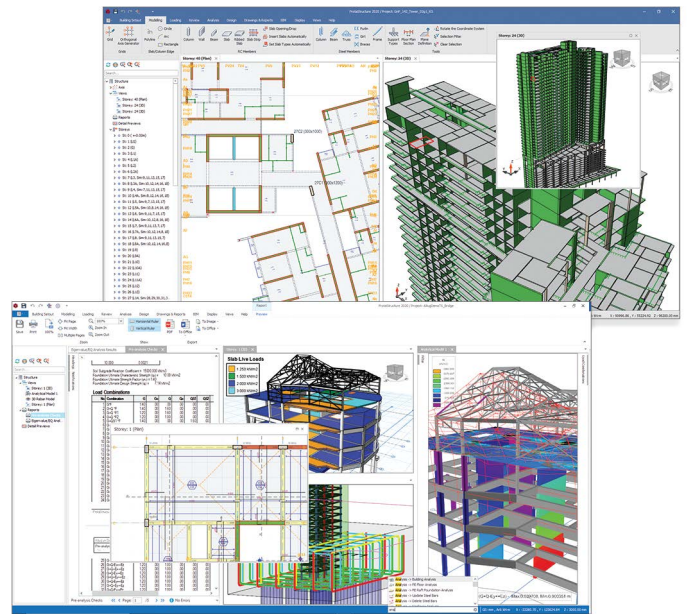
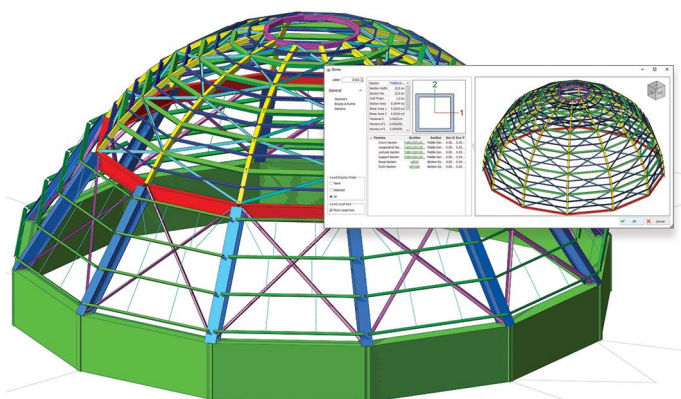
# Modelling

With its focus on structural BIM modelling, **ProtaStructure** allows **physical RC, Steel and Composite** structural members to be **easily, quickly and intuitively** defined in one model.

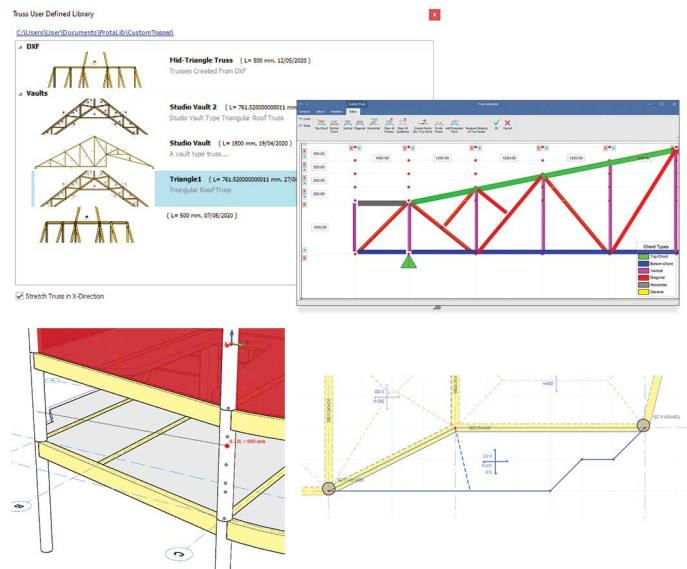
- Instantly **create models using smart DXF import** to extrude gridlines, beams, columns, slabs and shearwalls directly from structural or architectural drawings or make use of physical **BIM links** with **IFC's, Revit or 3D DXFs** to establish complete models with a click.
- Use dynamic input to rapidly create Concrete **beam, columns, slabs, foundations** and **shearwalls** and custom shaped **corewalls** and **columns**. Define **openings, drops** and **physical set out** to exactly define your project.
- Use real structural steel elements including **truss, purlin, brace, girt, sag rods** with flexible parametric macros. Specify your **splice locations** on steel columns, beams and trusses.
- Insert **steel dome** members with the help of the highly parametric wizard.
- Make use of the new general purpose **frame member** to model irregular arrangements with ease. Insert **curved** and **arch** frame members in any plane orientation in 3D.



- **Merge different model parts together** allowing concurrent modelling for rapid project creation.
- Fast generation of multiple storeys with **similar storey** feature.
- Simultaneously work on different floor plans and 3D model with **multiple window system**. Easy access to parts of model with element **Filters**.
- Define different materials and reinforcement steel grades **on floor and element basis throughout the project**.



- Define conventional, waffle, precast and flat slabs with **curved** and **irregular edges** and **drop head panels**.
- Create **Raft, Piled-Raft, Pad Base, Pile Cap** and **Combined foundations** together with **Strip Footings** and **Foundation Beams** for complete foundation design. Set foundations up at **any level**.
- Build **custom trusses** using the truss editor and save them in the library for later use. Define multiple horizontal and vertical **braces** and use flexible purlin layout generators.

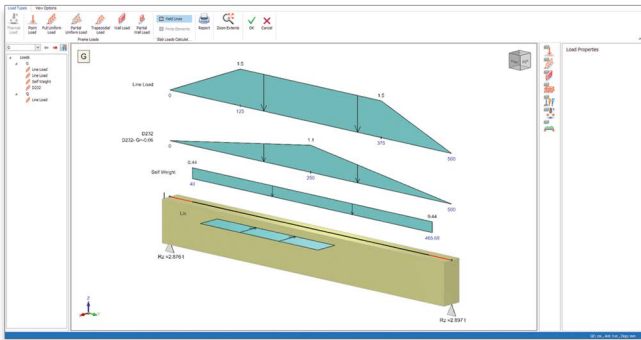


- Create **Arc** and **multi-segment axes/beams, sloping members** and structures with non-orthogonal plans.
- **Anchor** fixed column and beam positions to corners and edges. When section sizes change, anchored positions are retained.
- Model **sloping slabs, beams, columns** and sloping and tapered **shearwalls** easily using planes or multi gridlines.
- Assign flexible user-defined supports including springs under columns and shearwalls.

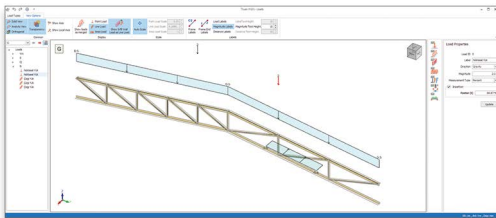
# Loading

Prota Software's unique loading processes are highly automated and accurate, saving you time and driving efficient design.

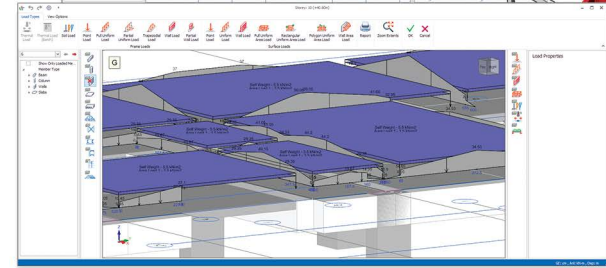
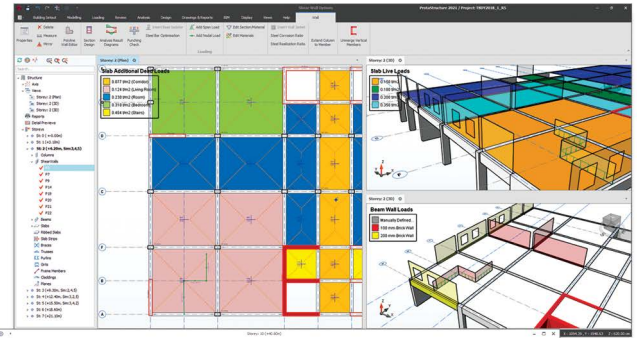
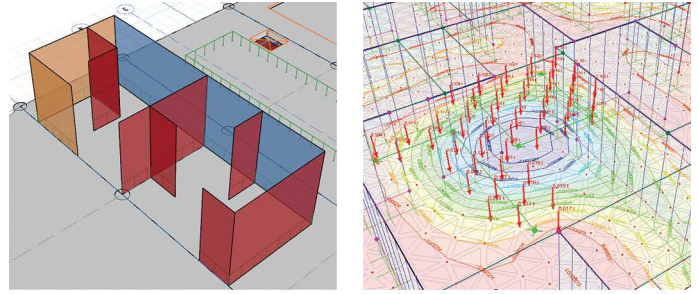
- Automatically decompose loads from plate, ribbed and waffle slabs, using **Yield Lines** and/or **Finite Elements Methods**. Apply point, line and patch loads to slabs.
- Assign point, function, distributed, area loads and concentrated moments to members in any direction with the new interactive loading editor.



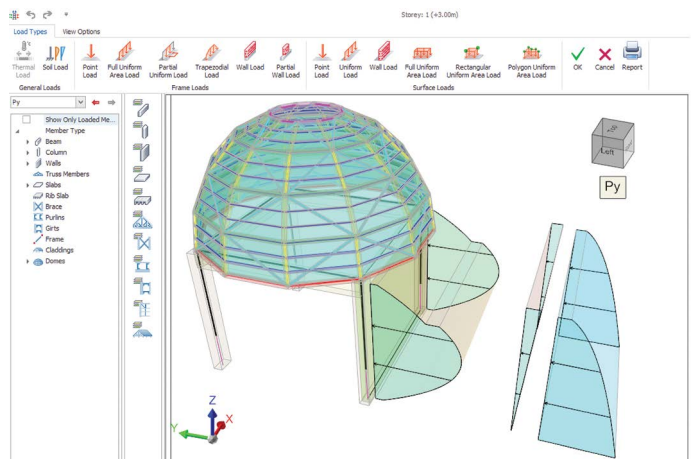
- Apply point, distributed and functions loads to truss members and truss joints. Concentrated moments can be applied as well.



- Visualize and inspect the loads on the physical model in 3D.
- Easily apply roof live loads, snow and rain loads to slab members.
- Create user-defined gravity and imposed load cases and assign loads to them. Categorize and review gravity loads on your structure and apply different combination factors where necessary.

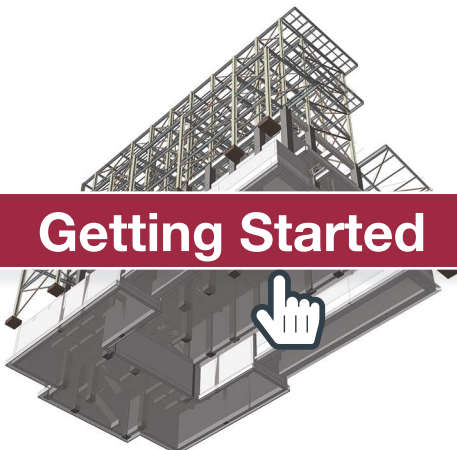


- Check model loads, finishes, elements sizes and properties using color coded **visual interrogation**.



- Automatic calculation of code-based seismic loads using **Equivalent Static** and **Response Spectrum Analysis** methods.
- **Automatic Wind Load Calculation** to EN1991-4(2005) BS6399-2(1997), ASCE7(2010) & MS1533(2002) and Thailand, NSR-10 (Colombia) codes.
- **Automatic Snow Load Calculation** to EN1991-1-3 and TS498
- Calculate static and dynamic soil thrust on basement or cantilever walls by entering water table and soil profile.

**Getting Started**

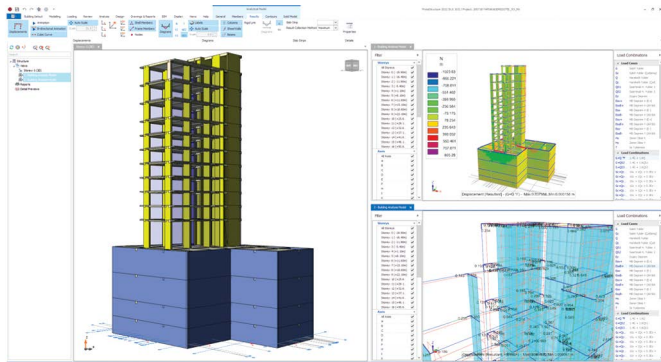
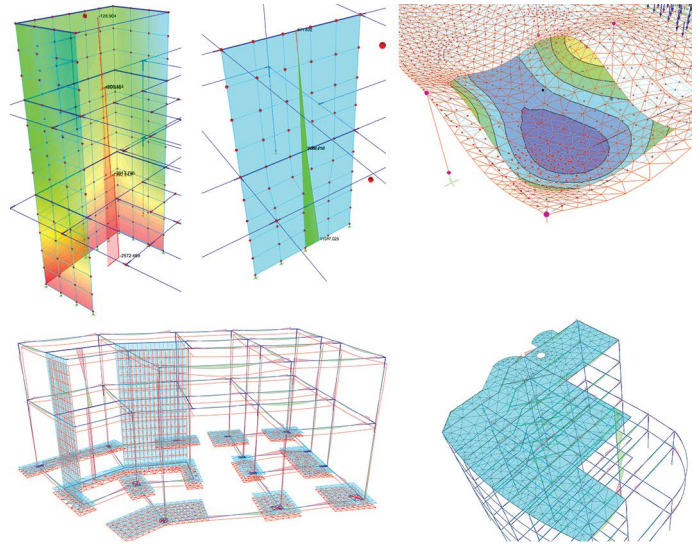


# Analysis

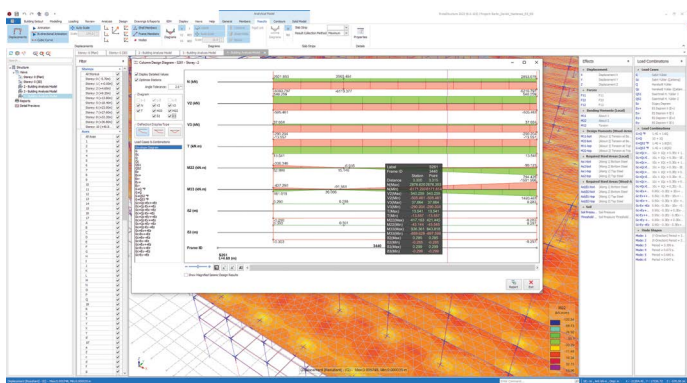
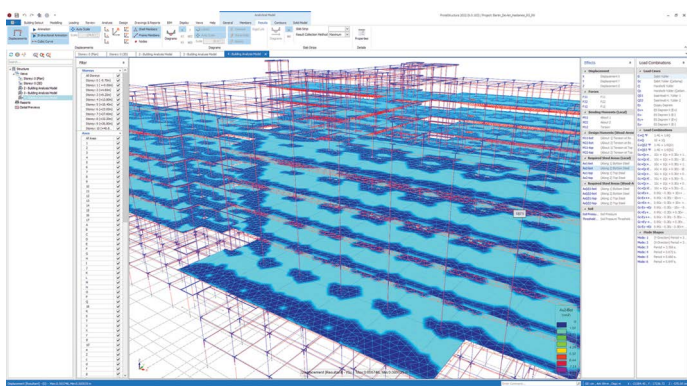


Structural analysis is performed by specifically developed 64-bit 3D finite element solver and state-of-the-art analytical model.

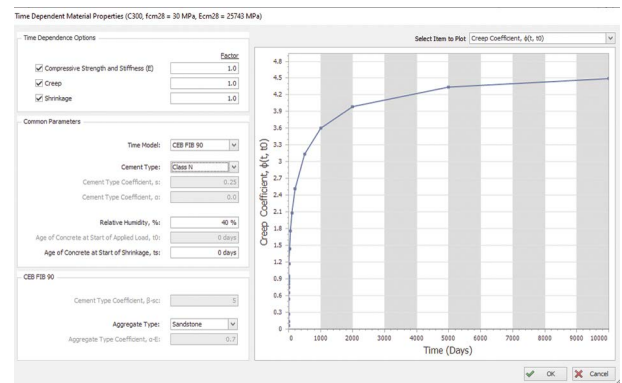
- Rapid analysis using multi-cores and pre-processing technology.
- Analysis of slab systems independently or **integrated with the structure** by using finite elements.
- Automatic **rigid links, rigid zones** and **asymmetrical end-releases** on frame members.
- Analysis of shearwalls and custom shaped corewalls with or without openings using **shell elements, mid-pier** and **single-pier** models.



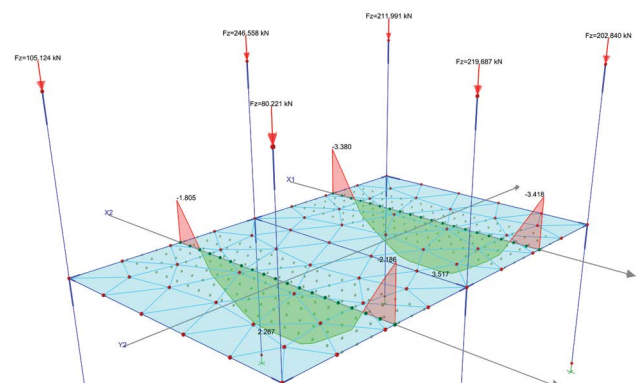
- Manage multiple analyses at the same time using the "Analysis Manager".
- Review the analysis results in a single integrated post-processor with a unified and performant animation, contouring, diagramming and rendering engine.



- **Staged Construction Analysis** considering creep and shrinkage to CEB FIB 90 and EN1992-1-1:2004.



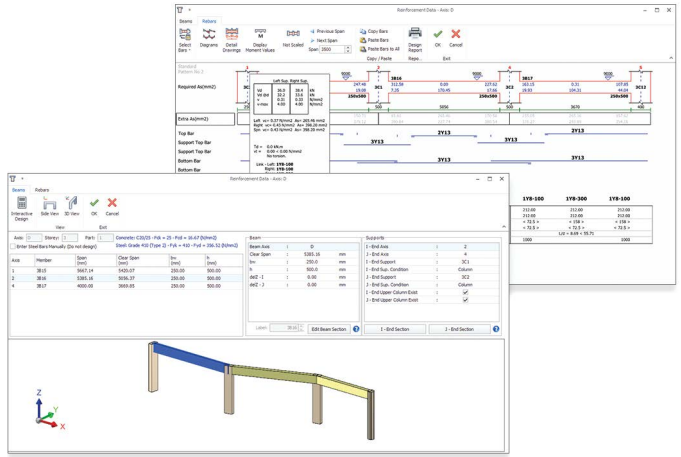
- **P-Delta** analysis and definition of equal/gradient **temperature differences**.
- Special **Seismic** Analysis considerations.
- **Soil-Structure Interaction Analysis** for all types of foundations in a single run.
- **Sophisticated Post Analysis checks** for reviewing code compliance including deflections.
- Real-time visualization of stress contours, deformations, force and moment **diagrams** for all load cases, combinations and envelopes with ease using the full-featured **Analysis Post-Processor**.
- Visualize the slab strip diagrams and station nodes on 3D analytical model including user-defined integral strips.



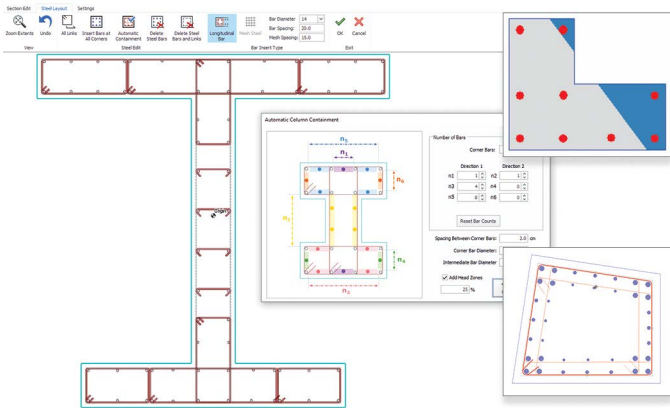
# Design

Design is the very essence of what we do as Structural Engineers. Providing elegant, practical solutions to design is at the heart of **ProtaStructure**

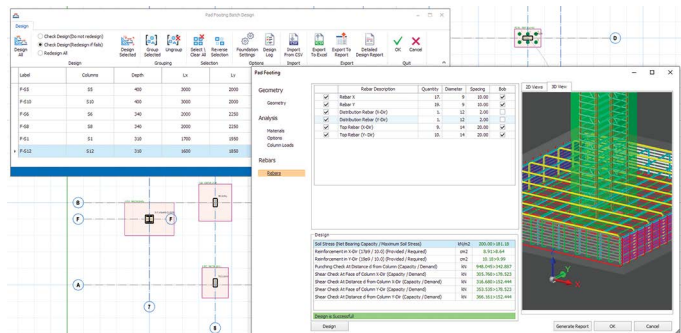
- **Interactive and batch concrete beam and column design including reinforcement optimizations, design grouping and user-defined rebar patterns.**
- **Biaxial design** and reinforcement optimization of columns and shearwalls with any section. Generation of interaction diagrams and capacity reports for easy design tracking.
- Design of shearwalls and slabs using conventional or **mesh** reinforcement.



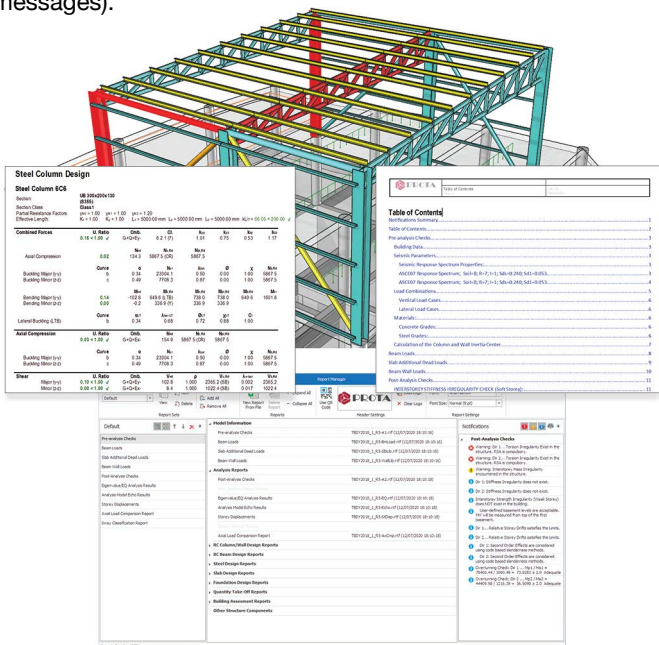
- Automatically create reinforcement layouts for columns and corewalls with "I, H, L, T, U, E, +" sections.
- Code-based **automatic containment tools** to specify link and tie-bar layouts compatible with column sections of any shape and size.
- Design economically and accurately by including **column sections** in FE mesh and considering openings, drops and loads on slabs in FE analysis.
- Design of flat, ribbed, waffle slab systems using analytical and finite elements methods and automatic punching checks.



- Selection of the most efficient **steel profile** based on active codes.
- Automatic design of **steel connections** using **IntelliConnect** and ability to reuse at all similar joints.
- **Integrated meshing** and analysis of slab and foundation systems with the building model.
- **Advanced documentation tools** including ordered report sets, integration of external reports, table of contents, smart notification system (summary of warning, error and information messages).



- Design **pad bases, pile caps, strip foundations, rafts, piled rafts, combined foundations and pedestals** using analytical and finite element methods.
- **Combine different models** to cater for shared foundation systems.
- Use different **subgrade coefficients** and **varied thicknesses** for within raft foundations.

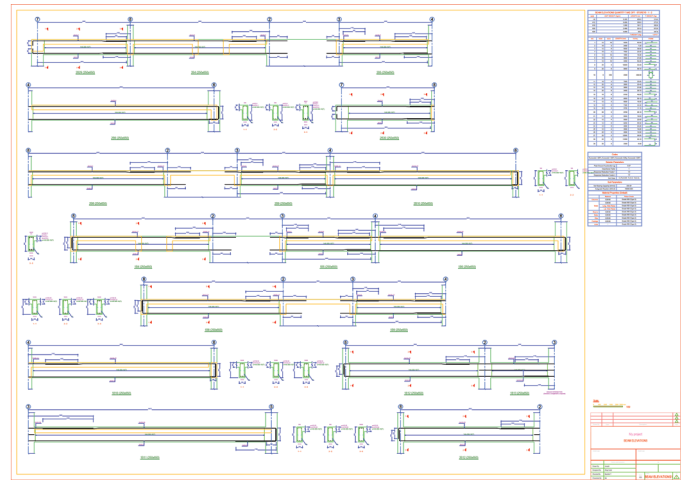




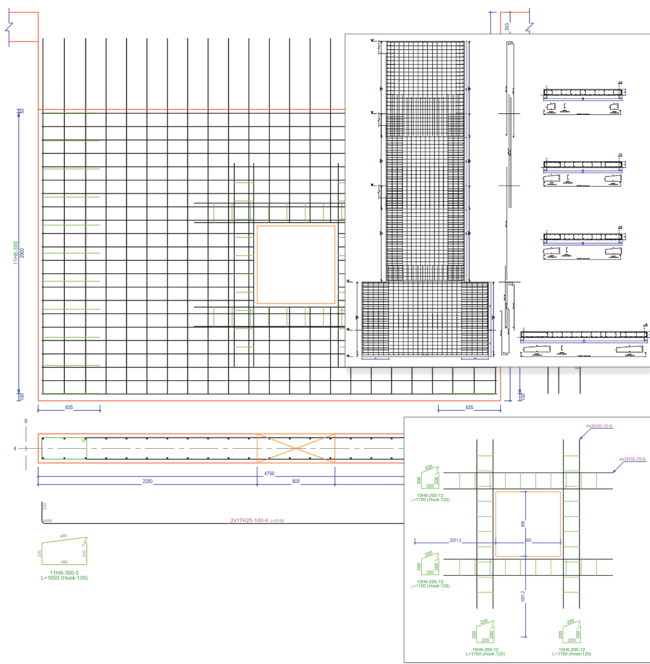


Engineers have longed for the ability to automatically create all RC detailing from the design, intuitively laid out into drawing sheets, and complemented with full drafting and editing capability.

- Automatically **produce details** from your **ProtaStructure** design models into your drawing sheets, only with one click.
- Carry out **all your drafting** using standard CAD drawing commands without the need for other CAD software. Features include extensive **command-line** support and customization, **DWG/DXF support**, dimensions, layers, style, **intelligent undo/redo** and much more...
- Generate **dynamic quantity tables** with **full bar bending schedules**, which are updated instantly when changes occur.
- Customize drawings with your **own title blocks** with auto referencing including all project and sheet information.

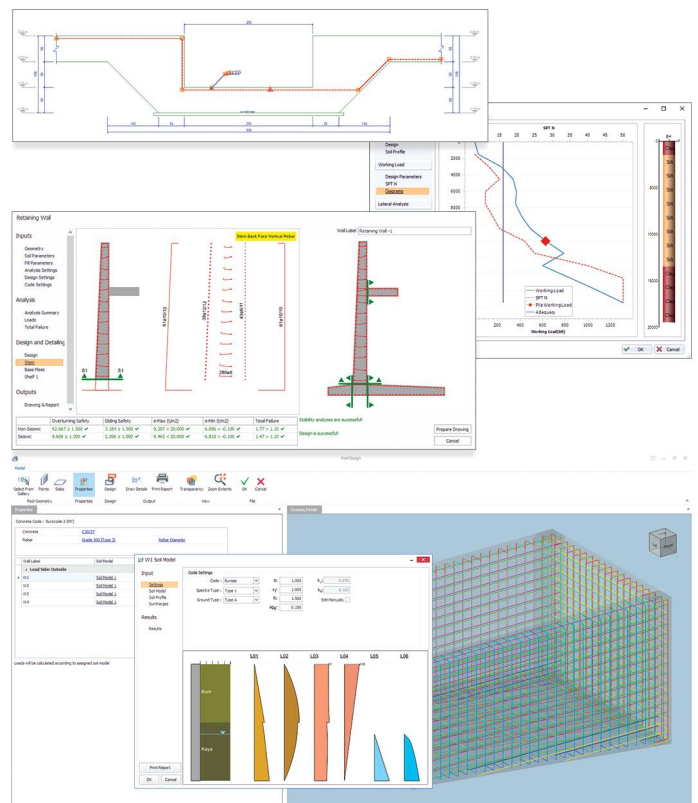


- Make use of **smart rebar library**, **intelligent detailing items** and **tools** to perform **semi-automatic structural drafting** for the cases where a full automation is not possible.
- **Automatically** or manually **truncate beam elevations** to fit any sheet layout.
- Convert your old reinforcement drawings to smart rebars and instantly provide steel quantity take off.
- Insert details with different drawing scales side-by-side on the same sheet. **Smart scaling system** automatically manages all relevant texts, object sizes and dimensions.
- **Automatically update design detail changes** from **ProtaStructure** as they occur.



Use **ProtaDetails'** growing library of intelligent macros to design and detail other components in your projects including;

- Automated analysis, design and detailing of **cantilever retaining walls**.
- Design of **RC Stairs, Pile Caps, Corbels, Steel Scaffold Systems, Swimming Pools** and more including all details, quantities and calculation reports.
- Design your **piles** using detailed soil profiles for **pile working load assessment**, iterative non-linear **lateral pile analysis** and **pile section design**.
- Produce **engineering details** for other components including Culverts, Retrofit Walls, Foundation Pits, Pad Bases, Walls, Continuous RC Beams and more.

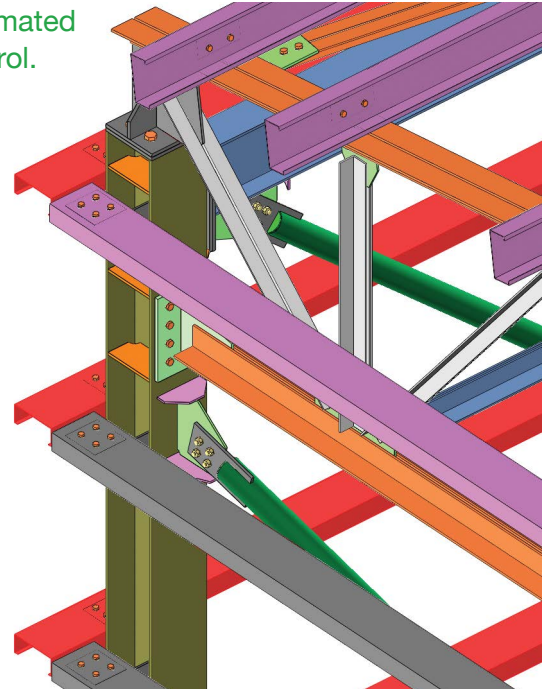




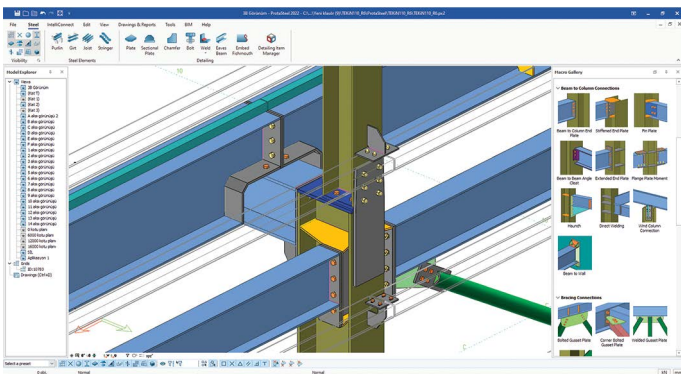
Nowadays clients want practical, complete steel details and automated connection design to drive on-time project delivery and cost control.

**ProtaSteel** is the all-in-one steel detailing solution for engineers, fabricators and drafting professionals.

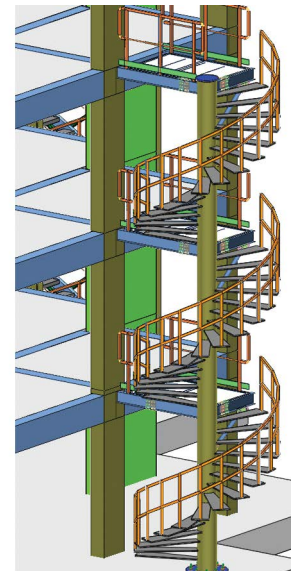
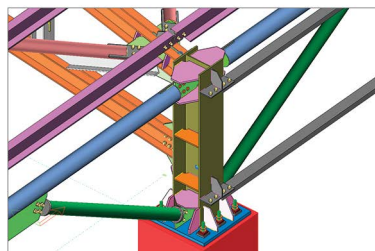
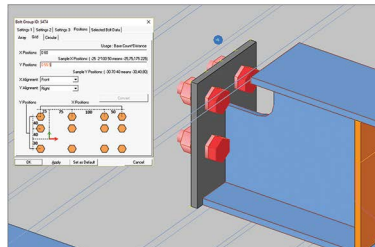
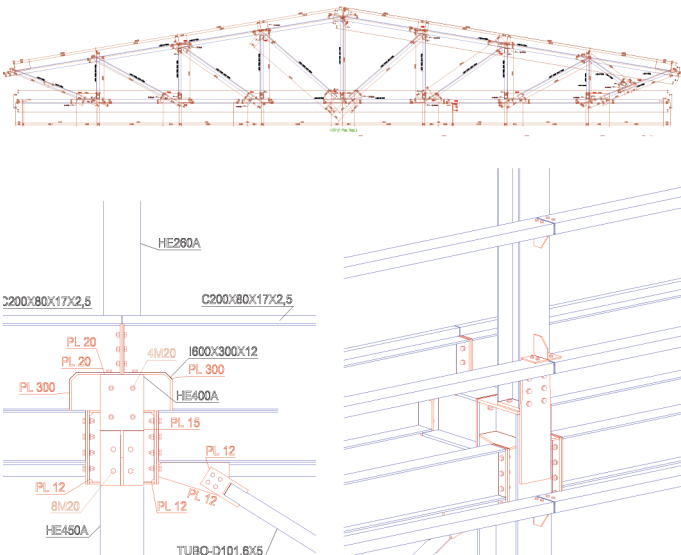
- Communicate **ProtaStructure** models seamlessly to **ProtaSteel** including all physical elements and analytical results.
- Use our unique **IntelliConnect** to rapidly automate connection design with a focus on constructability.
- Easily model and detail any steel connection using **Fully-featured Parametric Connection Libraries**.
- See the step-by-step **connection design calculations** with detailed **code clause referencing**.
- Insert **ancillary steel** including sag rods, purlins, girts, braces, stairs, chequer plate, railings, secondary beams and eaves beam to complete your model.
- Automatically **detect all clashes** between parts.



- 64 bit architecture and user-friendly interface with ribbon toolbar, macro galleries, smart wizards and filters.
- Create macro presets for any connection or modeling macro using your **favorite settings** and **company standards**. Seamlessly update any changes in **ProtaStructure** models to **ProtaSteel**.
- Fully-flexible **Automatic Part and Assembly Numbering** that intelligently manages part-marks on subsequent revisions of the model.
- Automatically prepare all **General Arrangement Drawings, Truss Details, Connection Details, Assembly, Part and Shop Drawings**.
- Full **cutting lists** provide insight into efficient procurement and cost control. **Intelligent data** communication with **IFC's, NC's**, and Tekla Structures.
- Easily create your own user-defined connections using general purpose tools like **plate, bolt, weld, section, cut, chamfer** and **fillet** and use these connections at similar joints.



- Increased productivity with **unique connection macros** including truss apex, truss-column, **steel beam to concrete**, and embedded steel connections.
- Automatically compile **comprehensive design reports** and track connection design status with model color coding.



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# Structural BIM Design Technology for a Connected World



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