# PROTA Structure® 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

**Prota**Structure *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.

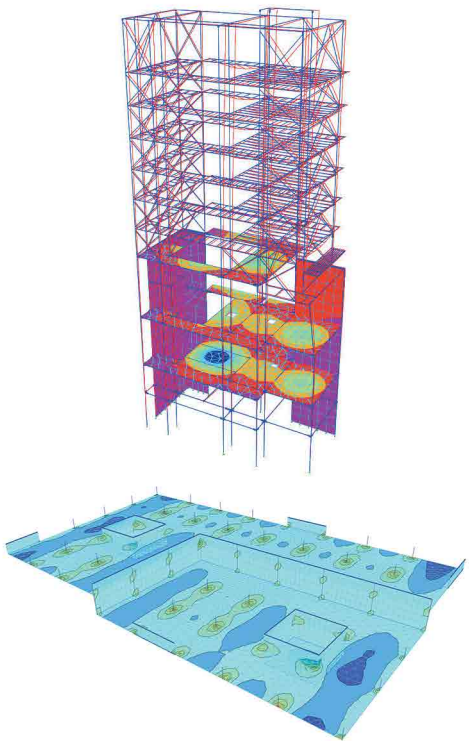
Produce high quality drawings and all design documentation from **Prota**Structure automatically using **Prota**Details and **Prota**Steel. Seamlessly coordinate projects with intelligent BIM integration.

**Prota**Structure saves time and increases business profitability.

PROTA SOFTWARE

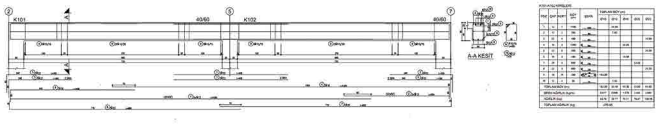
www.protasoftware.com

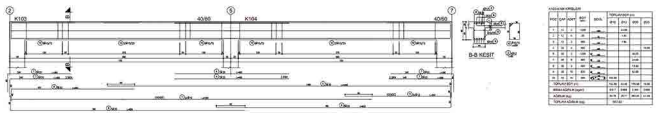
# At First Glance

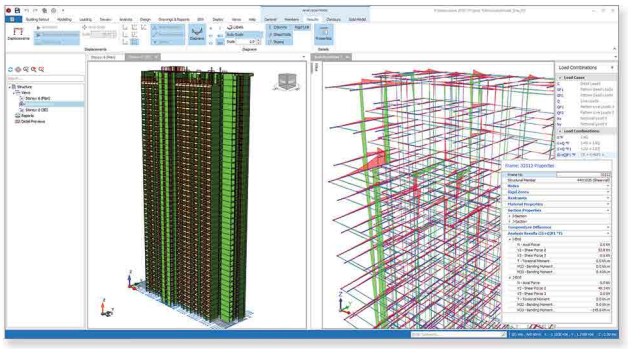


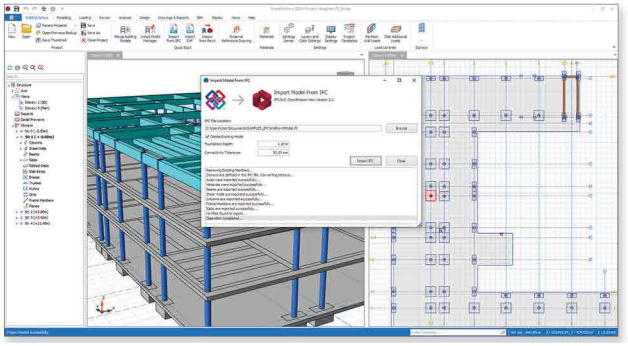
- Fast project delivery with fully integrated **Concrete, Hot-Rolled / Cold-Formed Steel** and **Composite Slab** design from one central structural BIM model.
- **Easy**, **quick**, and **intuitive** physical modeling and review with **Multiple Model Views** and **Dynamic Input**.
- **3D finite element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

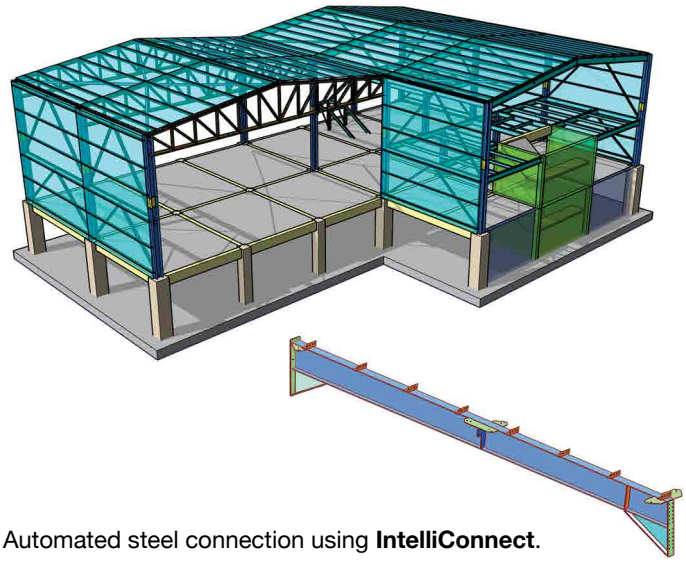
- Design to a range of leading **international codes** including **specialist seismic requirements.**
- Seismic assessment methodologies for Performance Based Design or Retrofit of buildings using **Linear Elastic, Nonlinear Single-Mode and Multi-Mode Pushover** or **Nonlinear Time-History analyses.**
- 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?

Step into the world of Prota Software and open endless possibilities for your business. For over **40** years, we have been at the forefront of providing cutting-edge structural engineering software solutions to professionals worldwide. Our innovative software solutions have been embraced with open arms by businesses in more than **100** countries, changing the game in the way they operate.



## Designed by Engineers for Engineers

Prota Software is committed to achieving engineering excellence and making a positive impact on the world. Our dedicated team is actively involved in technical research, presenting papers at conferences and global publications, and contributing to the development of codes of practice, particularly in earthquake design. Additionally, we maintain a strong mutual understanding and strategic collaboration with Prota Engineering, an independent consulting firm that has successfully completed projects in over 40 countries, focusing on large commercial and infrastructure projects such as airports and metro lines. Utilizing BIM technology, we efficiently handle both traditional and design-build projects, with a focus on optimal design and practical construction methods. Our flagship program, **Prota**Structure, is a direct result of our passion for sharing knowledge and is continuously shaped by our team's engineering expertise and invaluable feedback from our users worldwide.




## Leading BIM Expertise

At Prota Software, open BIM collaboration and knowledge sharing are core principles that have been instrumental in successfully delivering some of the world's most demanding infrastructure and transportation projects. The introduction of **Prota**BIM further solidifies Prota Software's position as a leading provider of advanced BIM technology by incorporating bi-directional links with the latest versions of Revit, IFC, DXF, SAF, IdeaStatica and other recognized BIM and Analysis formats. Through this enhanced capability, models can be seamlessly synchronized and design changes can be tracked, greatly enhancing project coordination and improving workflow efficiency.

## Advanced Analysis Features

Prota Software offers a wide range of analytic approaches for building design. From basic static, dynamic, and finite element analysis to advanced techniques like nonlinear single-mode and multi-mode pushover, nonlinear time-history, construction stage, and P-Delta analysis, Prota Software has the tools and expertise necessary to meet your design needs. Our proprietary analytic approaches are specifically tailored for building design and have been proven effective on a variety of projects. Whether you need to analyze the structural integrity of a small residential building or a large scale commercial development, 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, **Prota**Structure 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, localizations.



## Friendly Professional Support That Engages

Prota Software is devoted to improving its clients' experience with **Prota**Structure Suite. Our primary objective is to provide our clients with knowledge and practical, user-friendly assistance. Our comprehensive **Prota Help Center** and in-product learning resources are intended to enrich your understanding. Our team of professional support engineers is enthusiastic about engaging with our clients, whether it be answering technical inquiries or providing hands-on training. Prota Software team is prepared to assist you with any needs you may have.

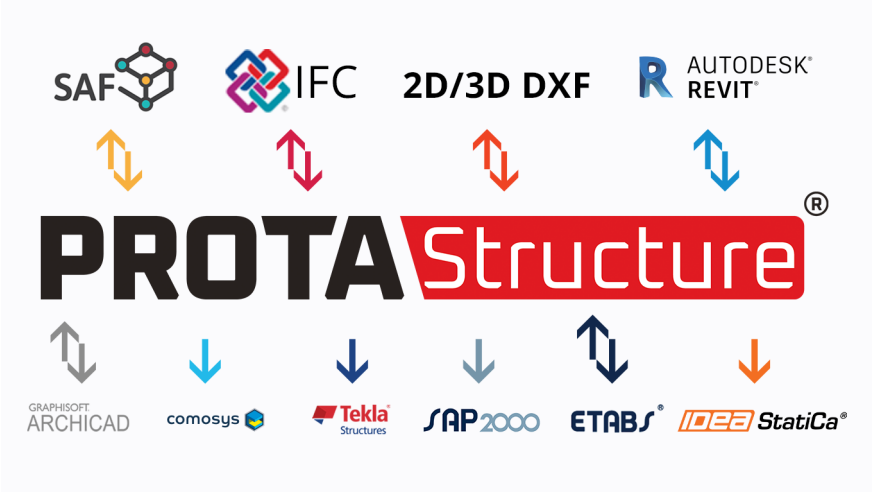
# Leading Structural BIM Collaboration

## Structural BIM at Its Core

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

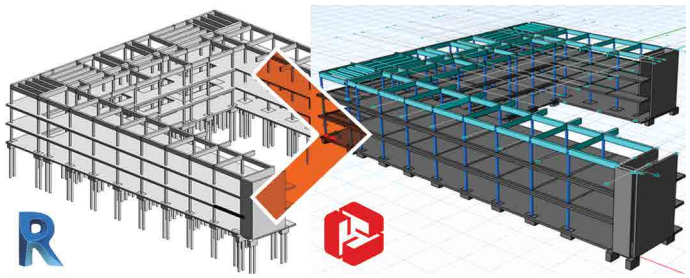
## Support for BIM Industry Standards

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



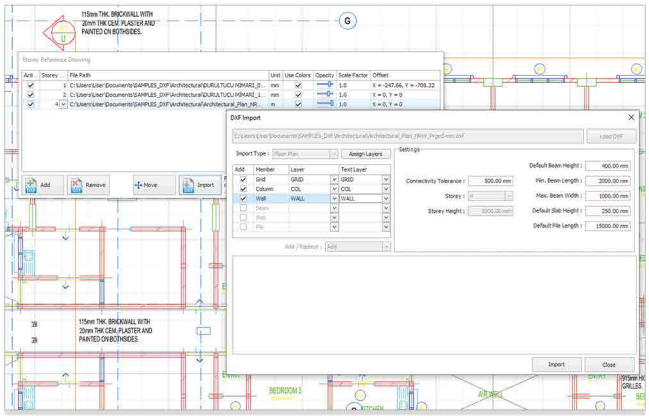

## Bi-directional Integration with Autodesk Revit

Prota Software has developed bespoke integration with **Autodesk Revit** to facilitate direct, seamless model coordination, providing tools to round trip 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.



## 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 **Prota**Structure 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 **Prota**Structure models. Architectural drawings can be overlaid against structural floors to aid **coordination**.

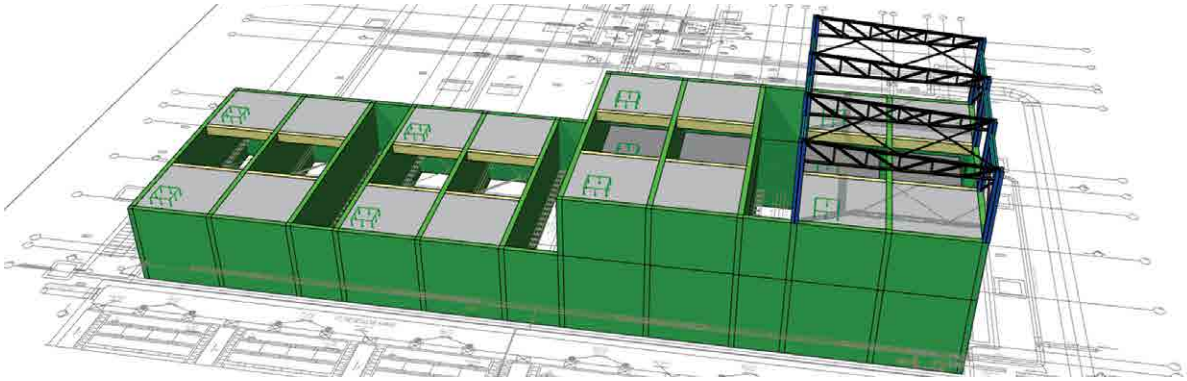


## Analysis Model Collaboration

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. **Prota**Structure allows you to easily achieve this with **open intelligent model links** to OpenSees, ETABS™, SAP2000™, LUSAS™, IdeaStatica, 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 **Prota**Structure 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.



# Seismic Analysis and Design Capabilities

**Prota**Structure 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

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

### Seismic Parameters and Response Spectra

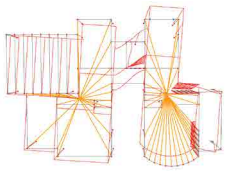
Horizontal and vetrical elastic and design spectra are calculated automatically using code-specified parameters. Site-specific spectra can also be introduced. Mass sources are automatically calculated including consideration of varied live load participation.

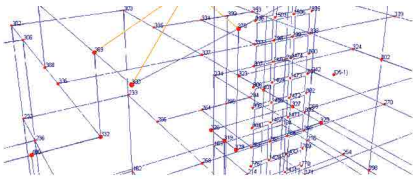
### Equivalent Static Earthquake Loads

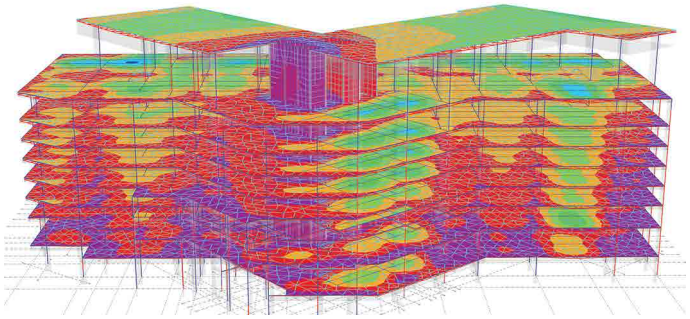
Static earthquake loads are automatically calculated and applied at story levels. **Multiple diaphragms** and **accidental eccentricities** are taken into consideration.

### Diaphragm Modeling and Story Meshing

**Prota**Structure 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. **Prota**Structure automatically detects Confined or Unconfined joints and checks against brittle failure.

### Seismic Forces on Non-Structural Members

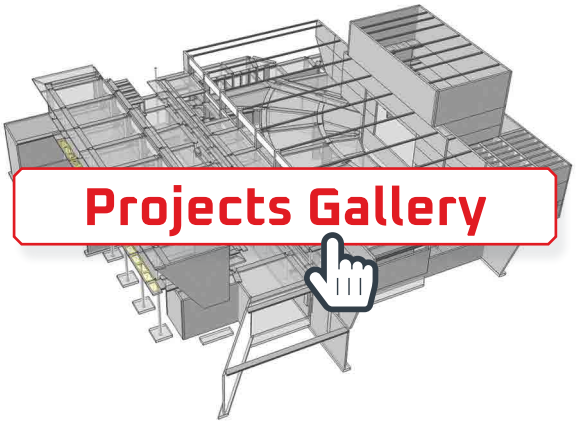
Forces acting on non-structural members and their connections to the building can be calculated to **ASCE07**, **Eurocode 8**, and **TBDY2018**. You just need to define the non-structural members and **Prota**Structure will automatically calculate the story accelerations and forces depending on the analysis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

### Seismic Separation of Buildings

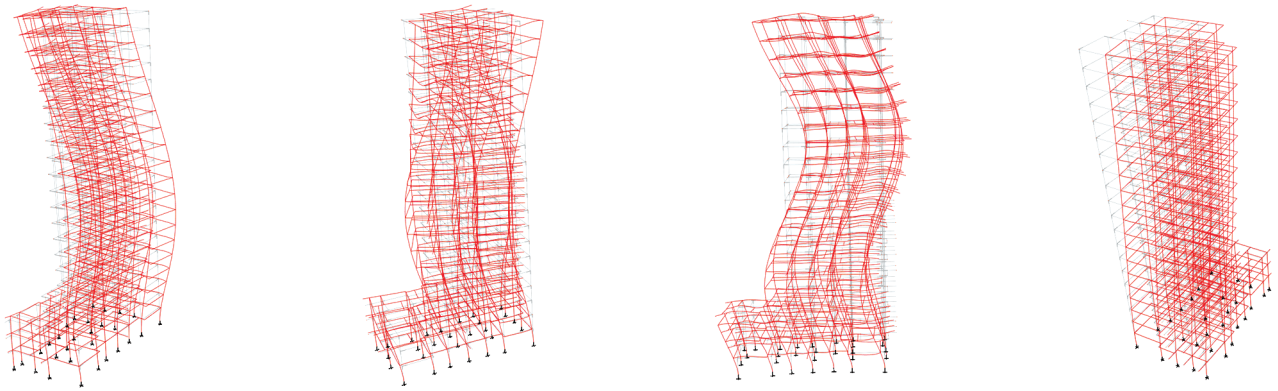
To avoid pounding damage in adjacent buildings, a spacing must be provided between them. With the **Seismic Separation Design** tool, you can either load the displacements of an existing second **Prota**Structure model or you can enter the displacement values of the second model manually. Calculations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

### Retrofitting and Assessment with CFRPs

**Prota**Structure is capable of retrofitting and assessment of beam and column members confined with Carbon Fiber Reinforced Polymers (CRFPs). 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.



# Seismic Analysis and Design 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 and displacements are automatically scaled with different factors to Equivalent Static results. Cumulative mass participation of modes is automatically calculated.

## Static and Modal Vertical Earthquake Analysis

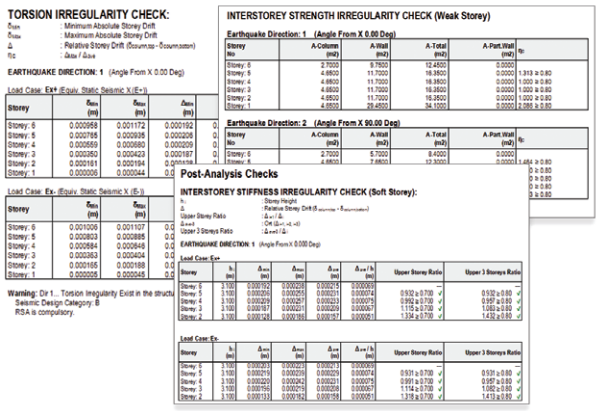
Response Spectrum analysis in vertical direction can be done to precisely calculate vertical earthquake effects in buildings with large span beams, slabs, cantilevers, transfer or slanting columns/walls. Vertical acceleration spectrum and mass distribution are automatically calculated.

## 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

**Prota**Structure 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.

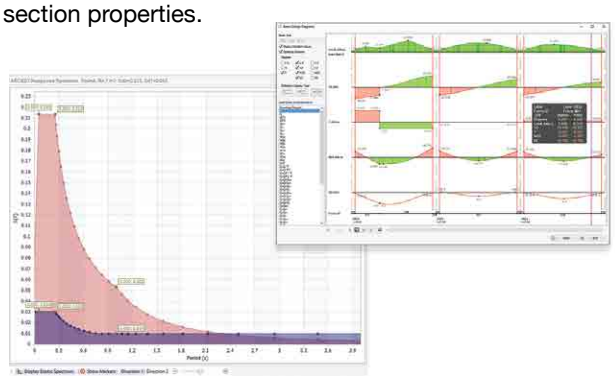



## Linear and NonLinear Seismic Isolators

Seismic isolators can be inserted anywhere on the structure for different seismic isolation scenarios. Both upper and lower structure design can be performed in **Prota**Structure target code spectra or ground motions. Nonlinear isolator properties can be considered in time-history analysis. Outputs like storey drifts, accelerations, internal forces, isolator displacements are reported as a part of the design.

## 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.

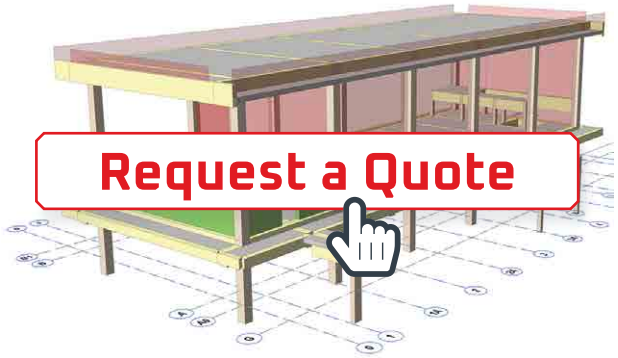


## Nonlinear Fiber Analysis of Sections

- 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.

## Nonlinear Static Pushover

- Single-Mode and Multi-Mode Pushover analysis are performed using **Prota**Structure - **OpenSees integration.** Parameters such as the number of steps and target displacements can be controlled by the user.
- After the analysis, the Capacity Curve for each mode is obtained. Users can specify the monitored node for which the curve will be generated. Results can be examined at any desired step and mode. A detailed performance assessment report is generated afterwards.



# Seismic Analysis and Design Capabilities

## Ductile Member Design and Detailing

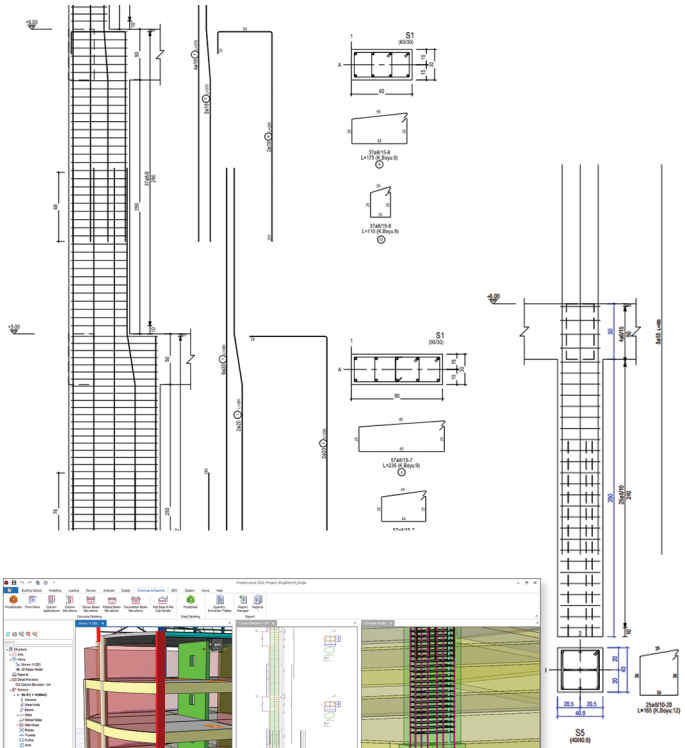
Columns, walls, and beams are designed to special ductility requirements. Automated confinement of beam and column critical sections, wall end zones (boundary elements), wall design envelope, capacity shear design and much more are automatically considered.

## Diaphragm Integrity and Load Transfer Checks

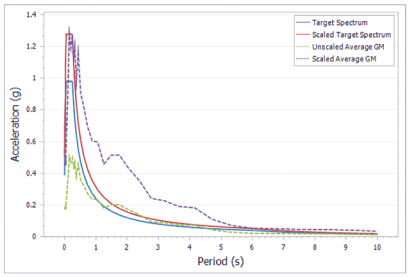
Transfer of inertia loads between slabs and lateral load resisting members including shearwalls and collector beams is automatically verified. For flexible diaphragms, in-plane shear, tension and compression stresses are checked to prevent diaphragm failure.

## 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.





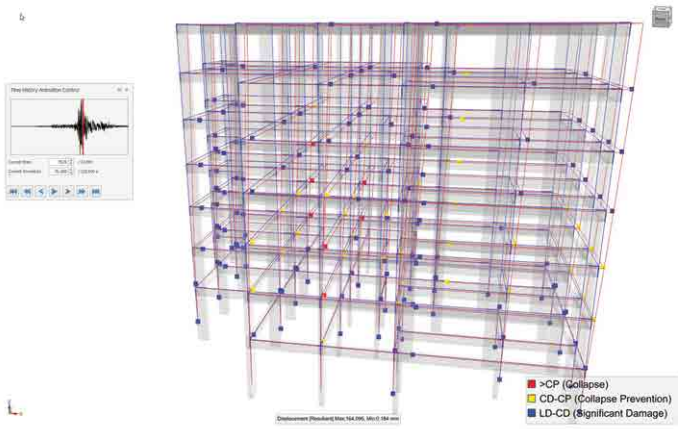



**Time History Parameters**

| 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 |

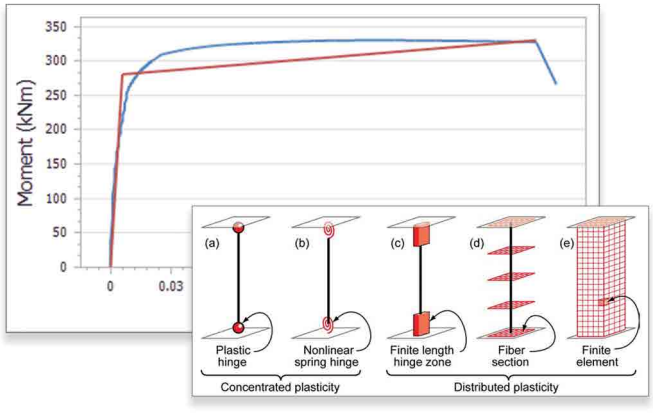
## ProtaStructure for Performance-Based Design and Building Assessment

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




## Nonlinear Time-History Analysis

- Nonlinear Time-History analysis can be performed using **Prota**Structure - **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 **Prota**Structure 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. Nonlinear Properties of Seismic Isolators can be considered in Time-History analysis.
- Time-History animation can be shown for selected accelerograms with plastic hinge mechanism indicating color-coded damage state at each step.



# Design Codes

Structural engineers around the world prefer to employ their own local approaches to both design and detailing. At Prota Software, we deeply understand this need. We offer a comprehensive suite of leading international design codes, enhanced by specific customization capabilities to satisfy local requirements—including robust support for Eurocode Annexes and Nationally Determined Parameters (NDPs). This ensures compliance and precision, no matter where your projects are located.

### Reinforced Concrete Design Codes

| Code Name/Abbreviation | Country |
|---|---|
| ACI318 [2008] | United States |
| ACI318 [2011] | United States |
| AC1318 [2014] | United States |
| ACI318 [2019] | United States |
| BS8110 [1997] | United Kingdom |
| CP65 | Singapore |
| HK [2004] | Hong Kong |
| TS500 [2000] | Turkey |
| NTE-060 | Peru |
| SNI 2847 [2019] | Indonesia |
| NSCP [2015] | Philippines |
| IS 456-2000 | India |
| NSR-10 C | Colombia |
| Eurocode 2 Base Code | European Union |
| Eurocode 2 (UK) | United Kingdom |
| Eurocode 2 (IR) | Ireland |
| Eurocode 2 (SG) | Singapore |
| Eurocode 2 (MY) | Malaysia |
| Eurocode 2 (HK) | Hong Kong |
| Eurocode 2 (PL) | Poland |
| Eurocode 2 (RO) | Romania |
| Eurocode 2 (MKD) | Macedonia |

### Loading and Wind Codes

| Code Name/Abbreviation | Country |
|---|---|
| ASCE07 [2010] | United States |
| ASCE07 [2016] | United States |
| BS6399 | United Kingdom |
| DPT 1311-50 | Thailand |
| IS 875-2015 | India |
| NSCP [2015] | Philippines |
| NSR-10 B | Colombia |
| NTE-020 | Peru |
| TS498 | Turkey |
| MS 1553 [2002] | Malaysia |
| IS 875 (Part 3) [2015] | India |
| Eurocode 1 Base Code | European Union |
| Eurocode 1 (UK) | United Kingdon |
| Eurocode 1 (IR) | Ireland |
| Eurocode 1 (SG) | Singapore |
| Eurocode 1 (MY) | Malaysia |
| Eurocode 1 (HK) | Hong Kong |
| Eurocode 1 (PL) | Poland |
| Eurocode 1 (RO) | Romania |

### Steel Design Codes

| Code Name/Abbreviation | Country |
|---|---|
| AISC360-10 (LRFD, ASD) | United States |
| AISC341-22 | United States |
| BS5950 | United Kingdom |
| Eurocode 3 Base Code | European Union |
| Eurocode 3 (UK) | United Kingdom |
| Eurocode 3 (PL) | Poland |
| Eurocode 3 (SG) | Singapore |
| Eurocode 3 (ML) | Malaysia |
| Eurocode 3 (RO) | Romania |
| Eurocode 3 (MKD) | Macedonia |
| NBR-8800 | Brazil |
| TSC 2016 (LRFD, ASD) | Turkey |
| IS 800-2017 | India |

### Seismic Codes

| Code Name/Abbreviation | Country |
|---|---|
| IBC [2018] | United States |
| UBC [1997] | United States |
| SNI 1726 [2019] | Indonesia |
| NSCP [2015] | Philippines |
| DPT 1301/1302-61 | Thailand |
| IS 1893 [2016] | India |
| NSR-10 A | Colombia |
| NTE-030 | Peru |
| TDY2007 | Turkey |
| TBDY2018 | Turkey |
| P100 [2013] | Romania |
| Eurocode 8 Base Code | European Union |
| Eurocode 8 (SG) | Singapore |
| Eurocode 8 (MY) | Malaysia |

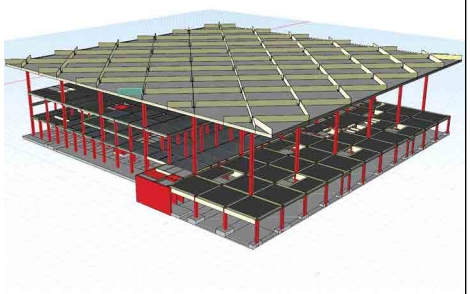
### Composite Beam / Slab Design Codes

| Code Name/Abbreviation | Country |
|---|---|
| Eurocode 4 | European Union |
| AISC 360-16 | United States |
| TSC 2016 | Turkey |

### Cold-Formed Steel Design Codes

| Code Name/Abbreviation | Country |
|---|---|
| AISI S100-16/20 | United States |
| EN 1993-1-3 | European Union |

# Project References



**İstanbul New Airport**

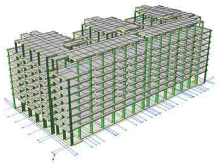
*Prefabricated Slabs*
Total Area: 1.500.000 sq. meters

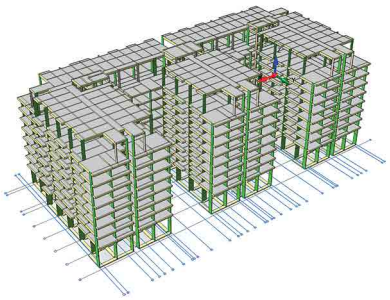
**Bartın Public Hospital**

*Seismically Isolated Building*
Total Area: 52.000 sq. meters

**AllSancak Residences**

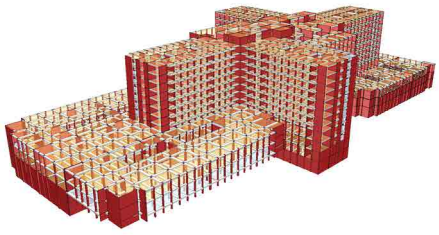
*High-Rise Concrete Building*
Total Area: 110.000 sq. meters





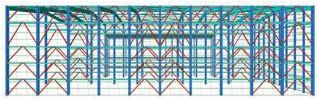
**Thu Thiem 2HA Residences**

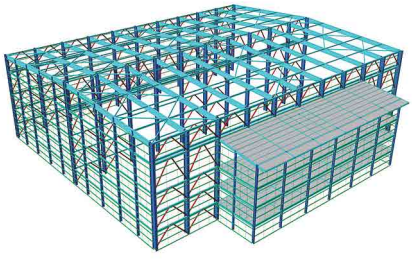
*Cast-In-Place Concrete Load-Bearing System*
Total Area: 20.000 sq. meters



**Marmara Basibuyuk Research Hospital**

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



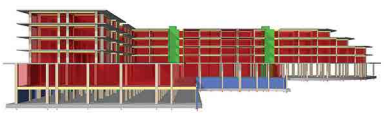


**Yacht Maintenance Facilities**

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

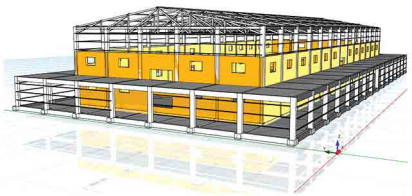
**Sahara Tower**

*High-Rise Concrete Building*
Number of Floors: 33-storey



**Onyx Ankara Residential Complex**

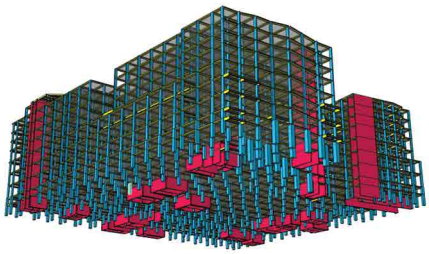
*Reinforced Concrete Frame Structure*
Total Area: 20.000 sq. meters



**Women and Children Development Initiative Foundation Center**

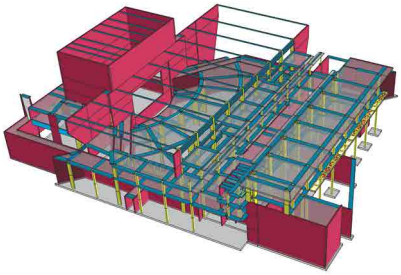
*RC Structure with Steel Truss Roof System*
Total Area: 20.000 sq. meters

# Project References



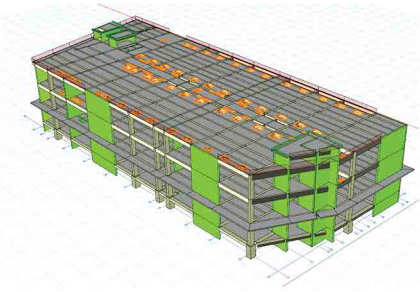
**Capa & Cerrahpasa Healthcare Campus**

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



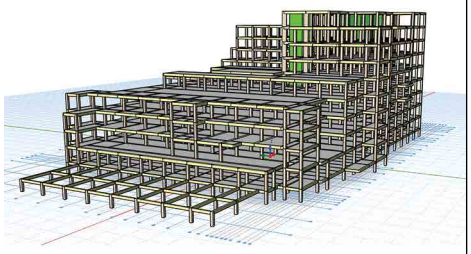
**TED College School Building**

*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

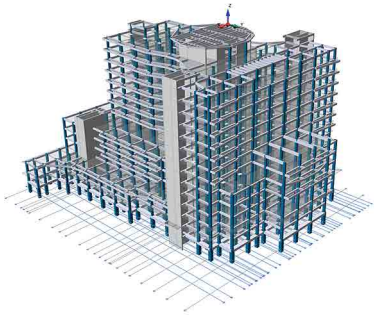


**Serdang Cardiology Hospital**

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

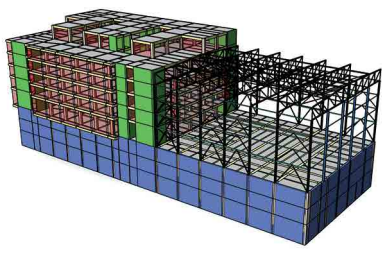
**High Rise Residential Kuala Lumpur**

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



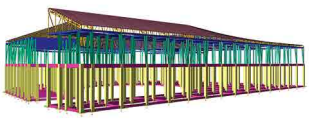
**Malatya State Hospsital**

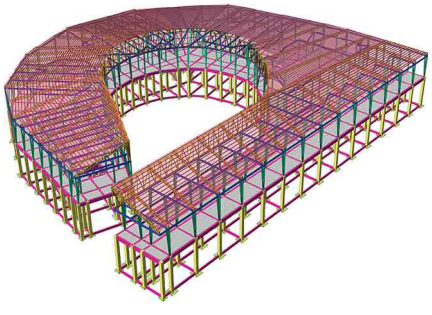
*Seismically Isolated Building*
Total Area: 52.300 sq. meters



**THY Maintenance Repair Overhaul Facilities**

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





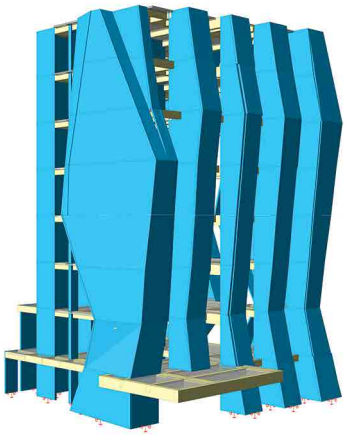
**Hospital Building**

*RC Structure with Steel Frame*
Total Area: 8.550 sq. meters

**Manisa Merkez Efendi State Hospital**

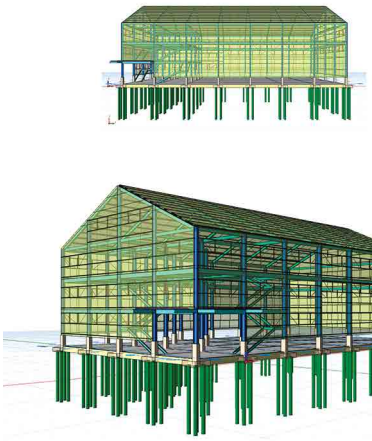
*Seismically Isolated Building*
Total Area: 115.000 sq. meters

# Project References



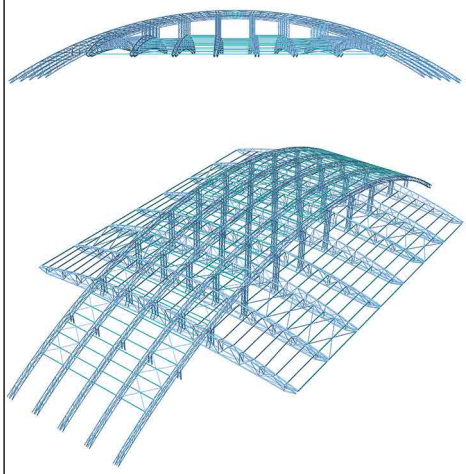
**Raid Tower**

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



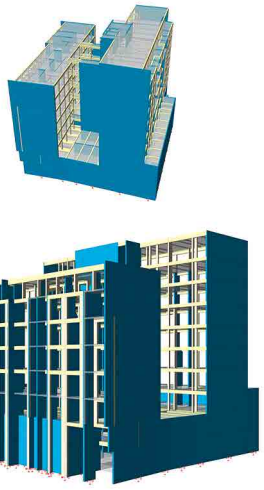
**Laboratorium Kalibrasi Metrologi DKI Jakarta**

*Steel Moment Resisting Frames*
Total Area: 1075 sq. meters



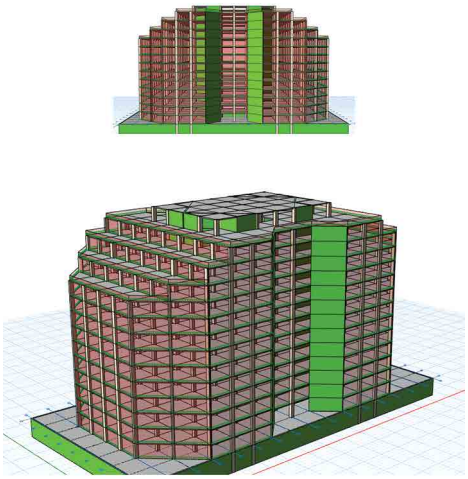
**Chekka Municipal Stadium Roof**

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



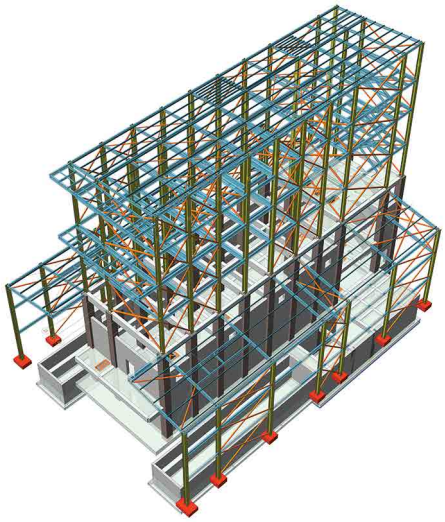
**Karpos Residential Building**

*High-Rise Concrete Building*
Total Area: 7874 sq. meters



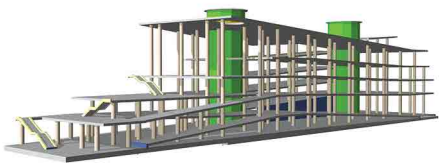
**Hexagon Ankara**

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



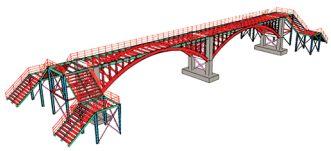
**1,000 Tons Capacity RC + Steel Facility**

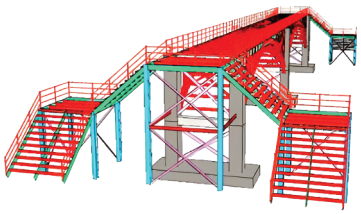
*RC & Steel Industrial Building*
Total Area: 2500 sq. meters



**Durrees Parking Lot**

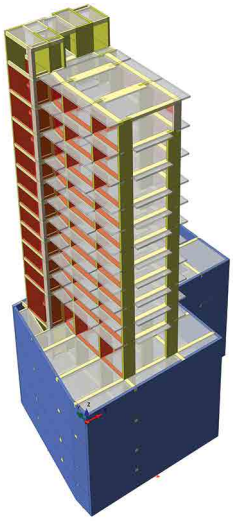
*Reinforced Concrete Frames*
Total Area: 15.000 sq. meters





**Santo Domingo Pedestrian Bridge**

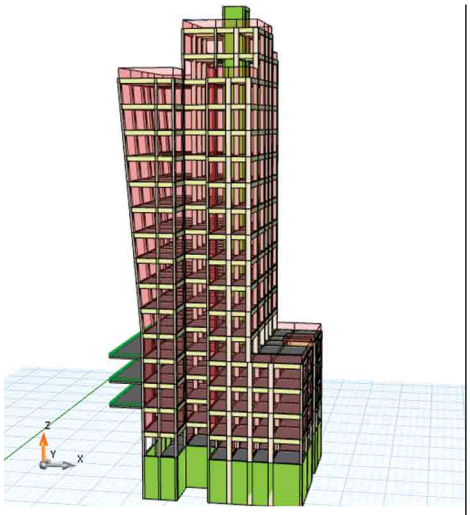
*Steel Structure*
Main Span: 54 meters



**Yapi Akademisi Hotel Building**

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

# Project References



**CCECC Office Complex**

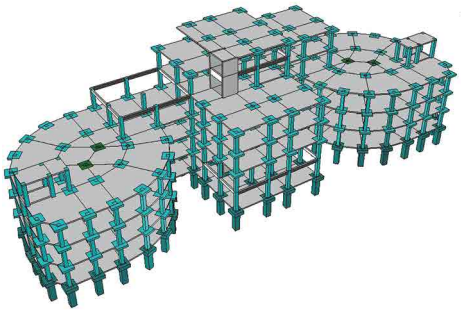
*High-Rise Concrete Building*
Number of Floors: 19-storey

**Majucita Office Tower**

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

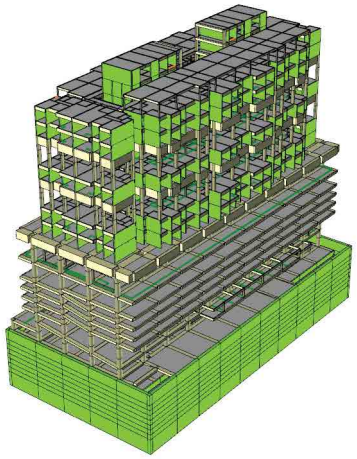
**KL High Rise Commercial Building**

*High-Rise Concrete Building*
Total Area: 90.000 sq. meters



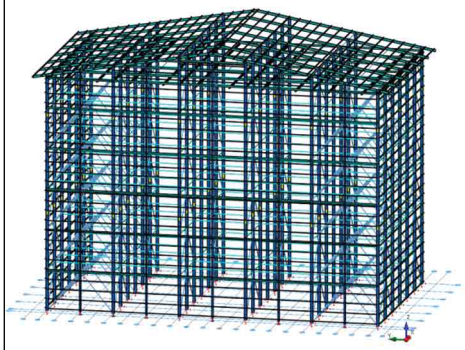
**Tokat Erbaa State Hospital**

*Seismically Isolated Building*
Total Area: 28.654 sq. meters



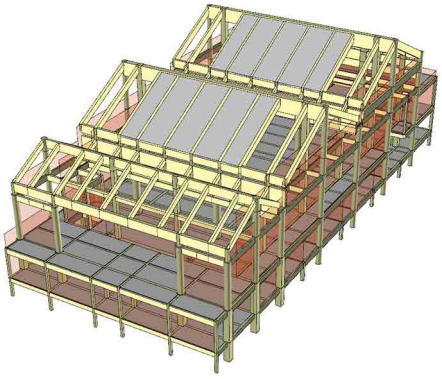
**Rizal Hood Multi-Purpose Building**

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



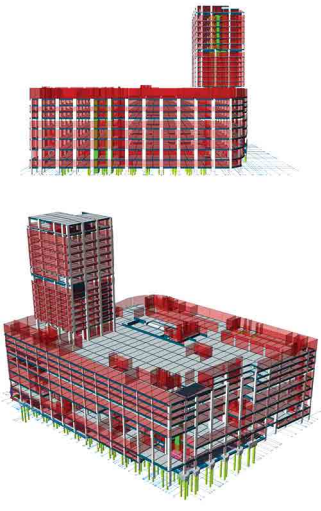
**Industrial Structure**

*Braced Frames*
Total Area: 960 sq. meters



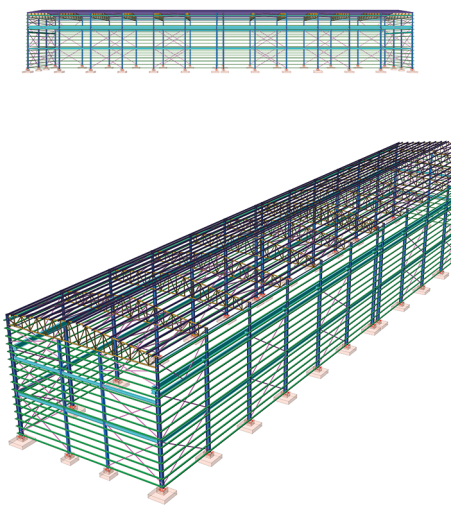
**LYS Complex**

*Concrete Frame Structure*
Total Area: 26.000 sq. meters



**Servay Retail Store**

*Multi-Purpose Concrete Building*
Number of Floors: 24-storey

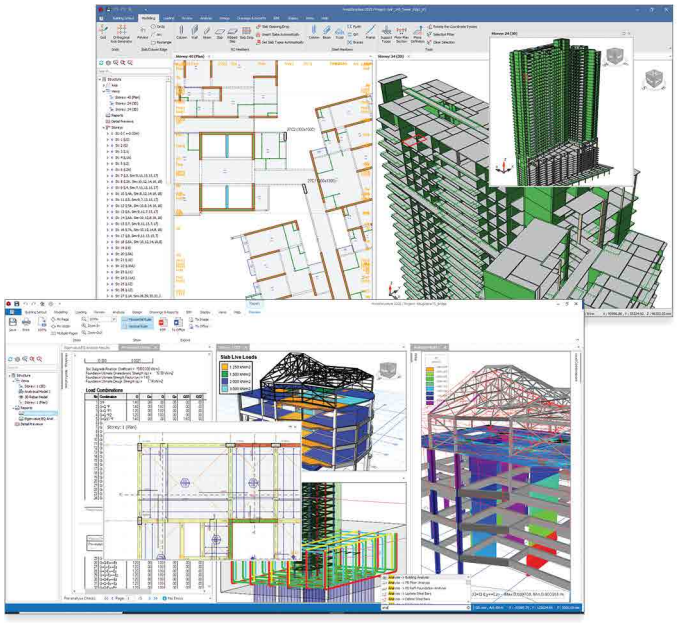


**Steel Hangar Building**

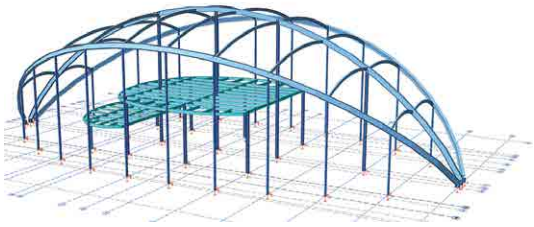
*Braced Frames*
Total Area: 1320 sq. meters

# Modelling

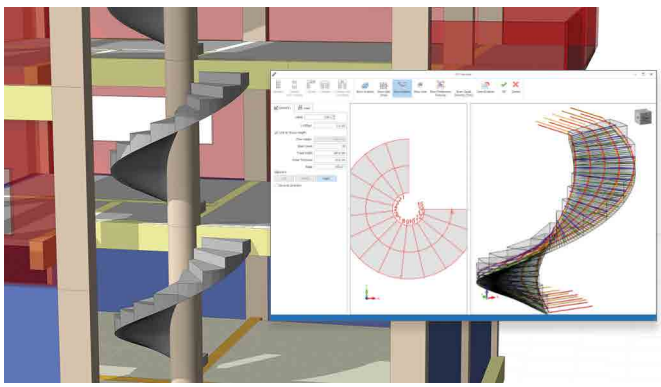
Engineered with a native structural BIM core, **Prota**Structure enables rapid multi-material physical modeling and robust cross-discipline coordination within a unified, central environment.



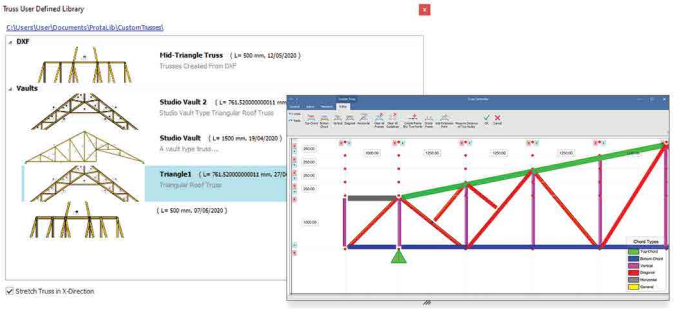
- Instantly **create models using smart DXF import** to extrude gridlines, beams, columns, slabs and shearwalls directly from structural or architectural drawings or make use of physical **BIM links** with **IFC's, Revit** or **3D DXFs** to establish complete models with a click.
- Leverage dynamic input to rapidly model **concrete members, foundations**, and **custom-shaped corewalls,** utilizing precise openings, drops, and physical offsets to exactly mirror project requirements.
- Use real structural elements including **planar truss, 3D space truss, steel domes, purlin, girt, brace, sag rods, claddings** with highly flexible parametric macros. Specify **splice locations** on steel columns, beams, frames and trusses.
- Insert **castellated** or **cellular beams** easily by specifying the web opening parameters.
- Model irregular arrangements with ease. Insert curved and arch frame members in any plane orientation in 3D. Use **Frame Group**s to quickly define multiple frames within a region.

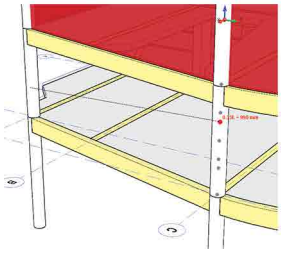


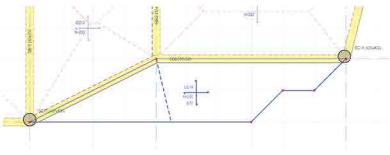
- Insert **primary** and **secondary composite frames** and **composite slabs** to create composite slab systems.
- Merge model partitions for concurrent modeling and leverage similar-storey replication to accelerate multi-storey project creation.
- Simultaneously work on different **floor plans** and **3D** model. Easy access to parts of model with element Filters. Batch manipulation of members with member selection groups.
- Define different materials and reinforcement steel grades **on floor** and **element basis throughout the project.**
- Model various **Straight, U-shaped, L-shaped** and **Spiral** staircase geometries parametrically.



- 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.



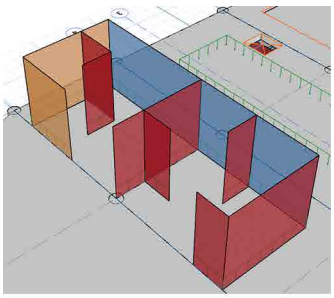


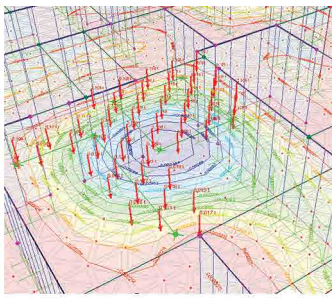


- Create **Arc** and **multi-segment** axes/beams, **sloping members** and structures with non-orthogonal plans.
- **Anchor** fixed column and beam positions to corners and edges. When section sizes change, anchored positions are retained.
- Model **sloping slabs, beams, columns** and sloping and tapered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

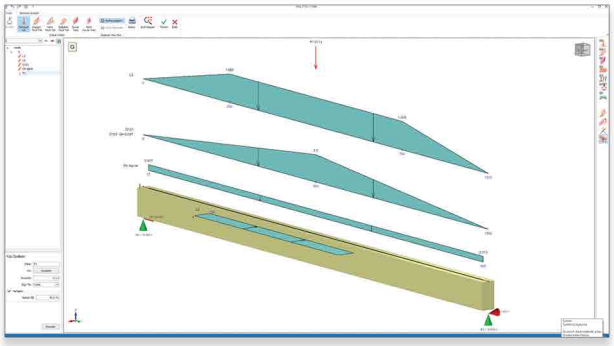
# Loading

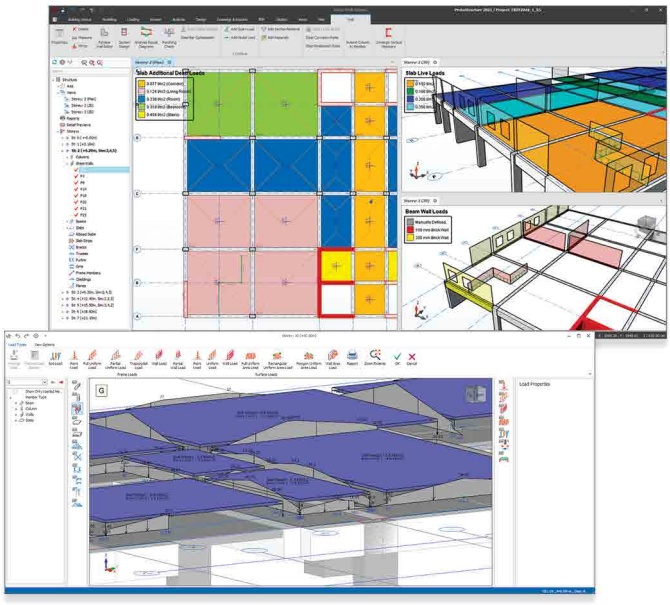
**Prota**Structure features a highly automated, high-precision loading framework designed to eliminate manual computation, maximize engineering efficiency, and accelerate code-compliant structural design.



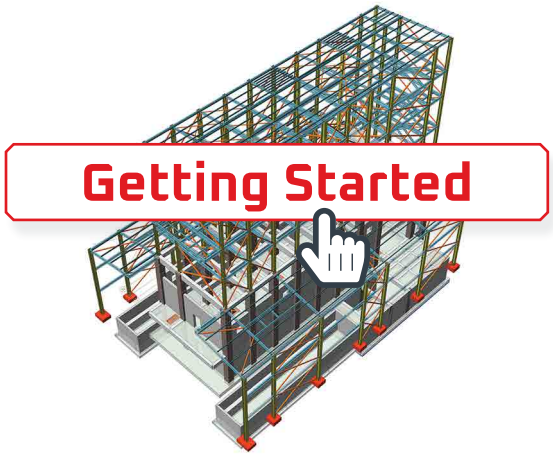


- Automatically decompose loads from plate, ribbed and waffle slabs, using **Yield Lines** and/or **Finite Element Methods.** Apply point, line and patch loads to slabs.
- Assign point, function, distributed, area loads and concentrated moments to members in any direction with the new interactive loading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

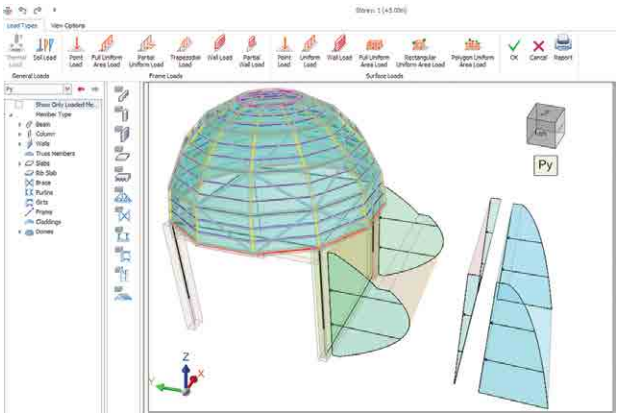




- Apply point, distributed and functions loads to truss members and truss joints. Concentrated moments can be applied as well.
- Visualize and inspect the loads on the physical model in 3D.
- Easily apply roof live loads, snow and rain loads to slab members.
- Import **point loads from Excel files** and assign to multiple columns easily for multiple load cases.
- 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.
- Make use of separate automated **ULS** and **SLS** combination groups for **Steel** and **Concrete** design. Create as many user-defined combinations as you need for each group.



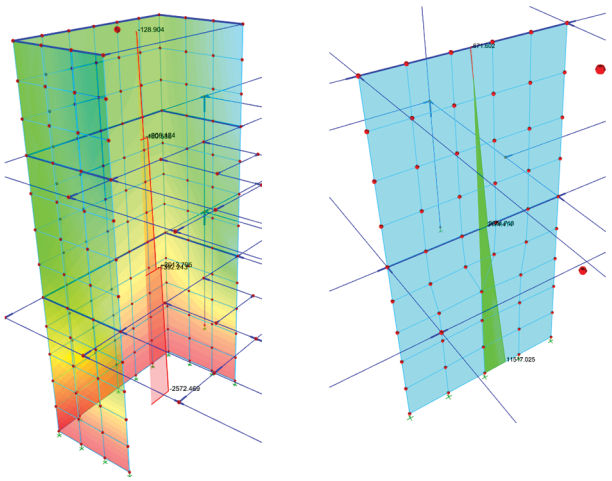

- Check model loads, finishes, elements sizes and properties using color coded **visual interrogation.**



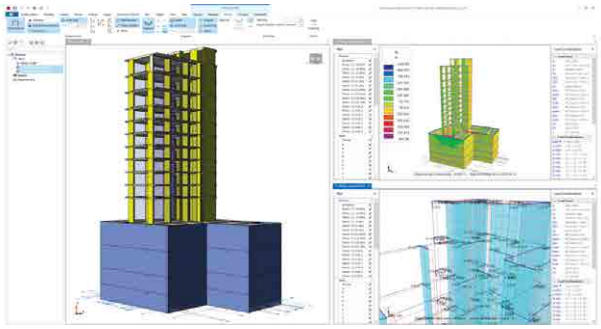
- Automatic calculation of code-based **lateral** and **vertical seismic loads** using **Equivalent Static** and **Lateral/Vertical Response Spectrum Analysis** methods.
- **Automatic Wind Load Calculation** to EN 1991-4 (2005), BS6399-2 (1997), ASCE07 (2010), MS 1533 (2002), IS875 (2015), NSCP (2015), NSR-10 (Colombia), Thailand, Peru and India codes.
- **Automatic Snow Load Calculation** to EN1991-1-3 and TS498
- **Automated Notional Load Calculation** for considering minimum lateral loads. Include them automatically in desired vertical or lateral combinations for **geometric imperfections.**
- Calculate static and dynamic soil thrust on basement or cantilever walls by entering water table and soil profile.

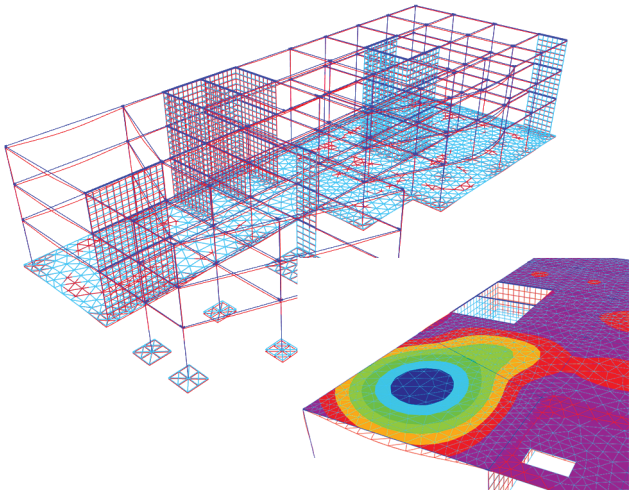
# Analysis

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

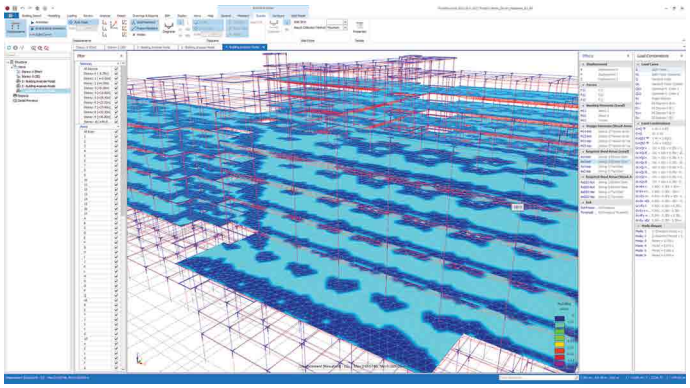


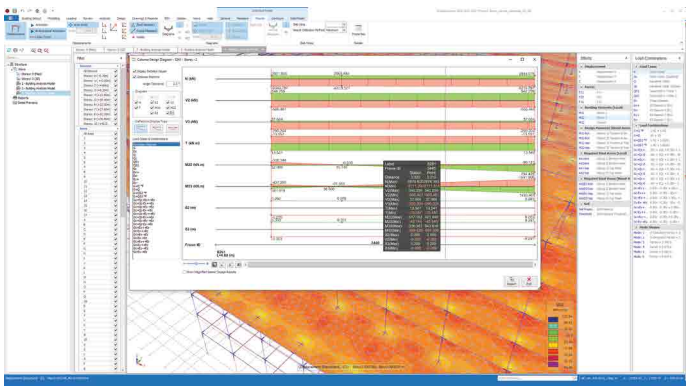
- Rapid analysis using multi-cores and pre-processing technology.
- Analysis of slab systems independently or **integrated with the structure** by using finite elements
- **Orthotropic** shell elements for one-way slabs combined with **knife-edge moment** and **contact releases** along slab edges.
- 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.



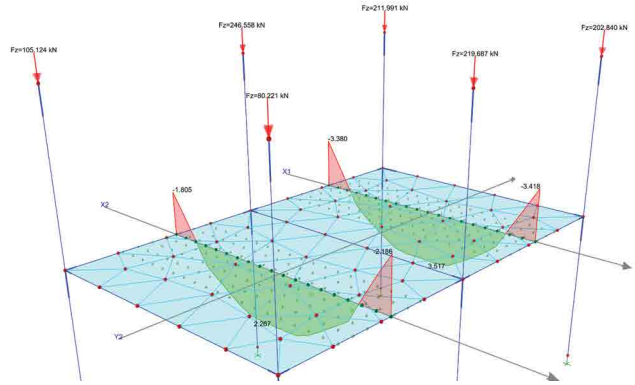


- Manage multiple analyses at the same time using the “Analysis Manager”.
- Review the analysis results in a single integrated post-processor with a unified and performant animation, contouring, diagramming and rendering engine.





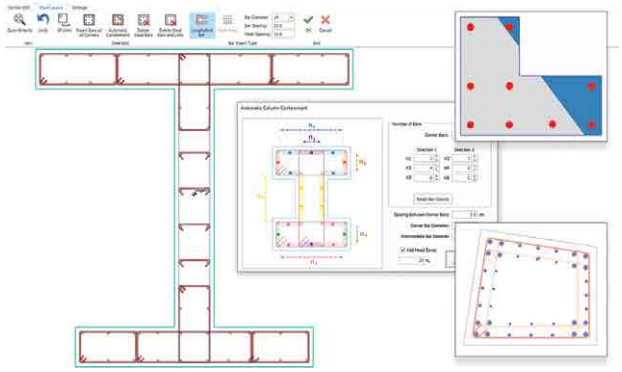
- **Construction Stages, P-Delta** analysis and definition of equal/gradient **temperature differences.**
- Special **Seismic** Analysis considerations.
- **Soil-Structure Interaction Analysis** for all types of foundations in a single run.
- **Sophisticated Post Analysis checks** for reviewing code 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.



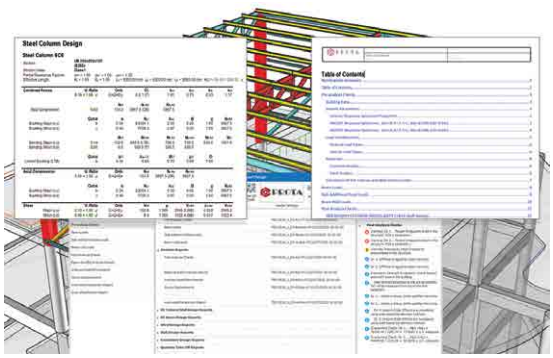
# Design

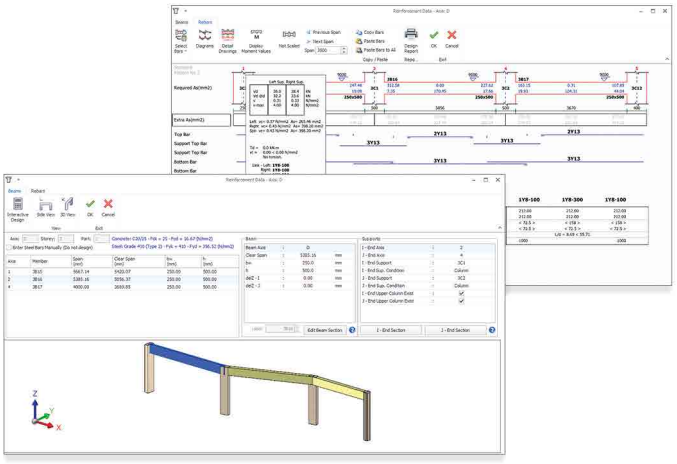
Design compliance and engineering precision form the cornerstone of structural engineering practice. **Prota**Structure delivers rigorous, code-based design compliance , balancing advanced optimization with constructability-focused structural deliverables.

- **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.

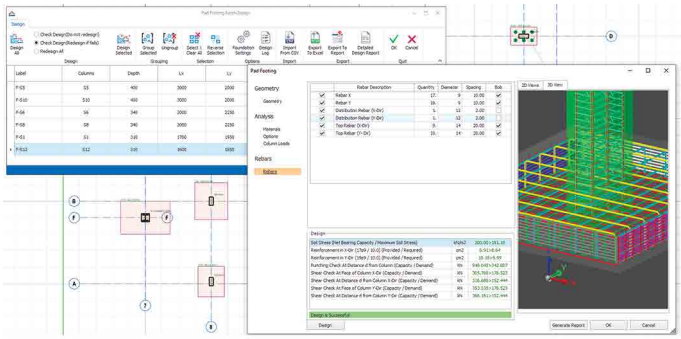


- Selection of the most efficient **steel profile** based on active codes.
- Automatic design of **steel connections** using **IntelliConnect** and ability to reuse at all similar joints.
- **Integrated meshing** and analysis of slab and foundation systems with the building model.
- Design of **composite slabs** with segmented or uniform shear studs considering construction and **final stages.**
- Design of **castellated** and **cellular steel beams** with detailed specialized checks including Vierendeel, Web Post Buckling, Horizontal and Vertical Shear Checks.
- **Advanced documentation tools** including ordered report sets, integration of external reports, table of contents, smart notification system (summary of warning, error and information messages).
- **Detailed design reports** with step-by-step calculations, **formulas** and **code references.**



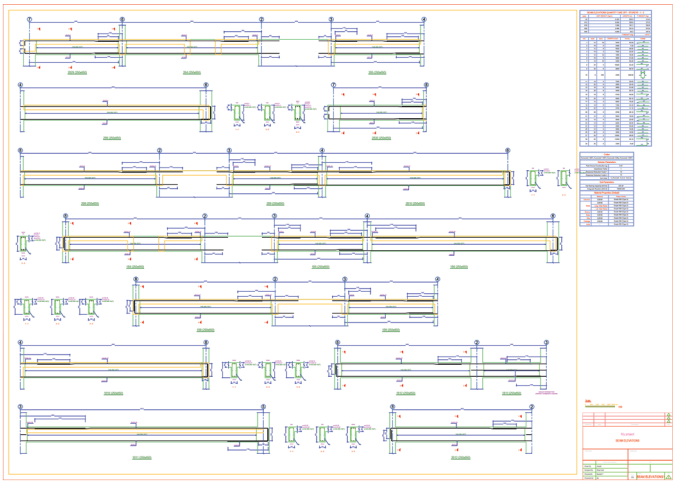


- Automatically create reinforcement layouts for columns and **corewalls** with **“I, H, L, T, U, E, +”** or **arbitrary complex** sections.
- Automatically create **end zones (boundary elements)** for rectangular and core walls. Specify end zone or web reinforcement easily.
- Code-based **automatic 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 **economical flat slabs** and **raft foundations** by automated **base reinforcement** and **slab patch panels** for additional support bars.
- Design of flat, ribbed, waffle slab systems using analytical and finite elements methods and automatic punching checks.

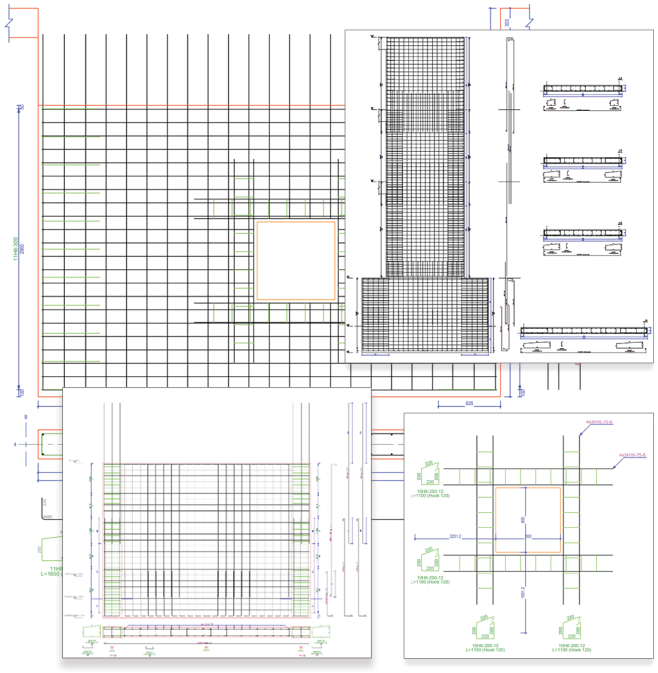


- Design **pad bases, pile caps, strip foundations, rafts, piled rafts**, and **combined foundations** using analytical and finite element methods.
- **Combine different models** to cater for shared foundation systems.
- Use different **vertical** and **horizontal subgrade coefficients** and **varied thicknesses** for within raft foundations.
- Finite Element analysis of foundations at different elevations, stepped foundations.

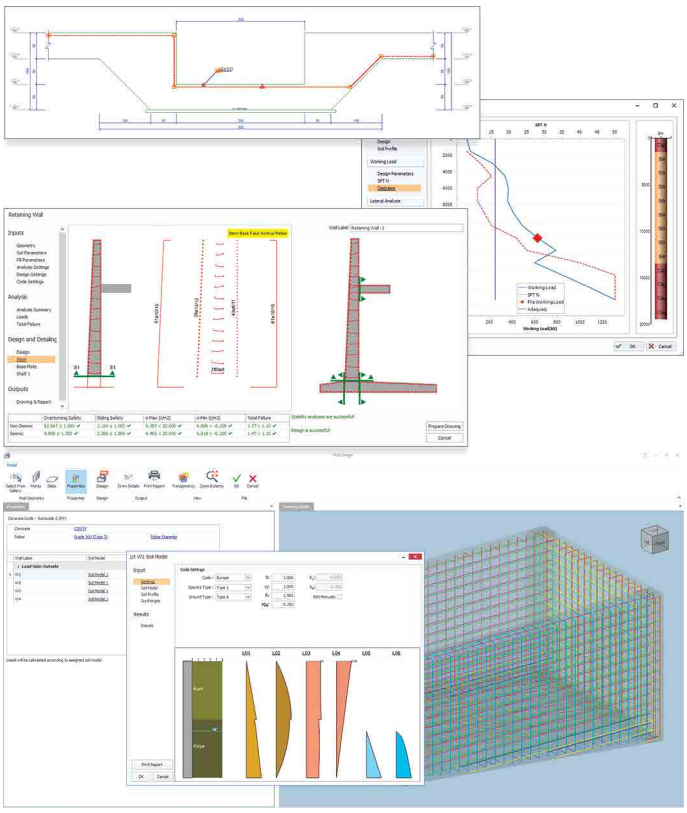
Engineering offices require the ability to instantly generate reinforced concrete detailing directly from design results. **Prota**Details delivers this by combining one-click automated layout generation with a fully-featured CAD drafting engine, enabling professionals to refine reinforcement drawings with ultimate precision.



- Automatically **produce details** from your **Prota**Structure 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.



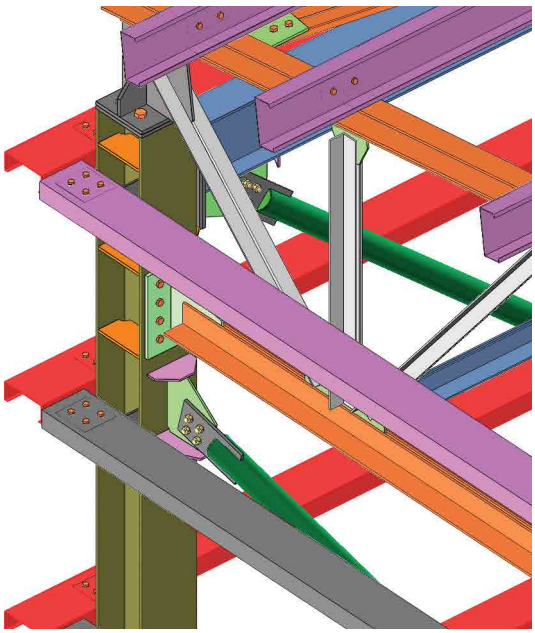
- Make use of **smart rebar library, intelligent detailing items** and **tools** to perform **semi-automatic structural drafting** for the cases where a full automation is not possible.
- **Automatically** or manually **truncate beam elevations** to fit any sheet layout.
- Convert your old reinforcement 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 **Prota**Structure as they occur.



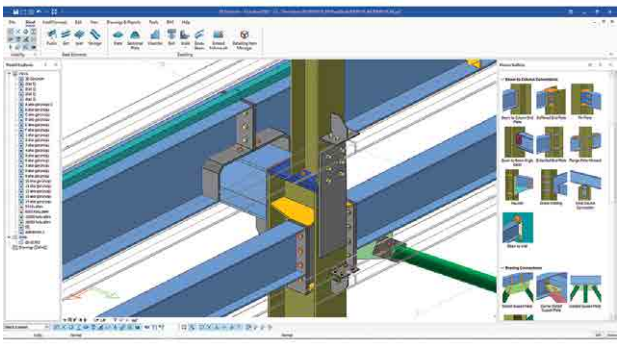
Use **Prota**Details' growing library of intelligent macros to design and detail other components in your projects including;

- 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.

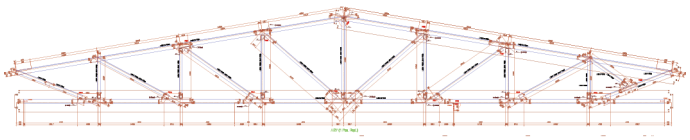
Modern structural projects demand precise steel detailing and automated connection design to guarantee on-time delivery and cost control. **Prota**Steel provides an all-in-one detailing environment for engineers, fabricators, and drafters, seamlessly bridging the gap between design analysis and fabrication-ready deliverables.

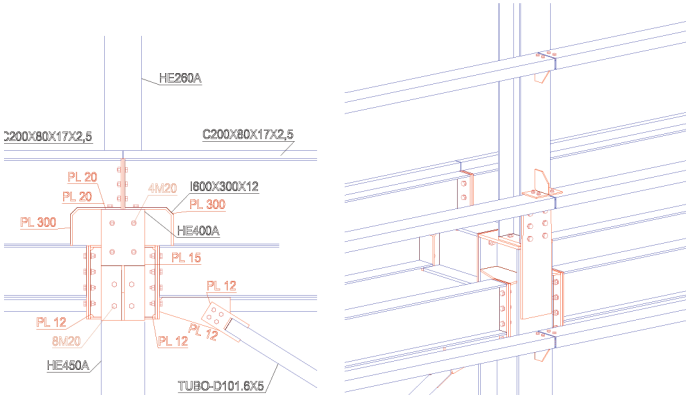


- Communicate **entire** or **only a selected part of Prota**Structure models seamlessly to **Prota**Steel including all physical elements and analytical results.
- Use our unique **IntelliConnect** to rapidly automate connection design with a focus on constructability.
- Easily model and detail any 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.

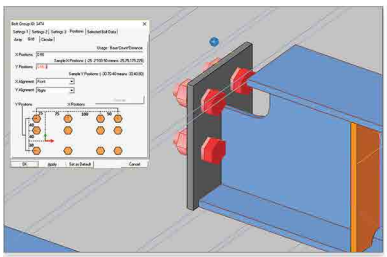


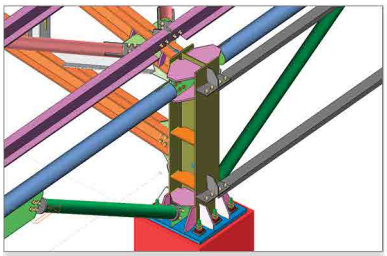
- Increased productivity with **unique connection macros** including truss apex, truss-column, **steel beam to concrete,** and embedded steel connections.
- Automatically compile **comprehensive design reports** and track connection design status with model color coding.

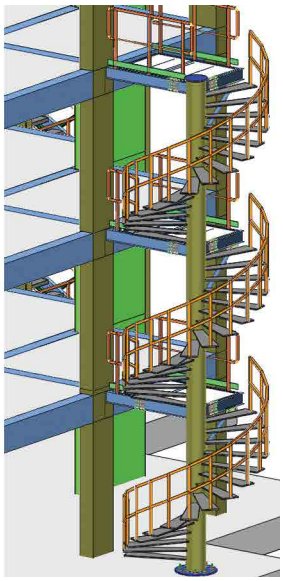





- 64 bit architecture and user-friendly interface with ribbon toolbar, macro galleries, smart wizards and filters.
- Create macro presets for any connection or modeling macro using your **favorite settings** and **company standards.** Seamlessly update any changes in **Prota**Structure models to **Prota**Steel.
- 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** with **SI** and **Imperial Units** support.
- Full **cutting lists** provide insight into efficient procurement and cost control.
- **Intelligent data communication** with **IFC's, NC's, Tekla Structures** and **IdeaStatica**.
- 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.







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