# ProtaStructure®

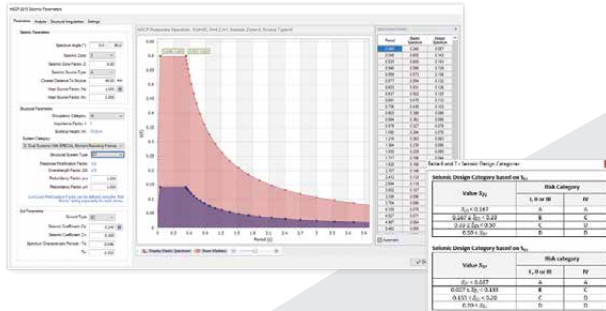**Prota**Structure **provides engineers with comprehesive capabilities to design and detail buildings quickly and economically to meet rigourous code requirements including US and EC Standards**

## Seismic Parameters and Response Spectra
Elastic and design response spectra is calculated automatically using code-specified parameters. Site-specific spectra can also be introduced.



## Two-Stage Analysis for Upper and Lower Structure
An automatic two stage analysis is performed in one go for buildings with rigid basements. Different mass sources for upper and lower structure are automatically considered.
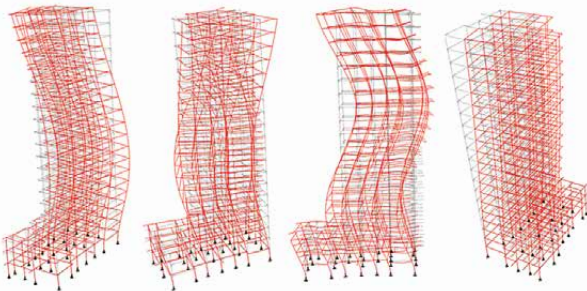


## Automated Calculation of Mass Sources
All seismic masses are automatically collected from different sources. Different live load participation factors can be assigned to each storey.
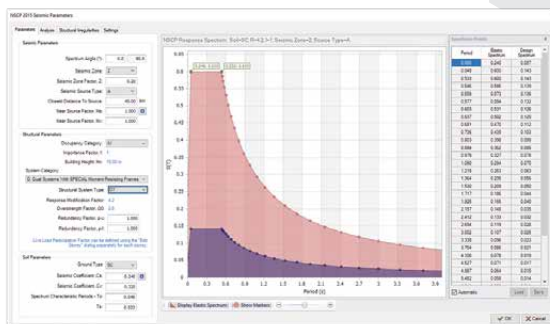
## 3-D Eigenvalue Analysis
A Natural modes of vibration are calculated including torsional modes. Dominant modes are automatically detected.



## Equivalent Static Earthquake Loads
Static earthquake loads are automatically calculated and applied to storey levels. Multiple diaphragms and accidental eccentricities are taken into consideration.



## Building Base and Height Check
Periods of dominant modes for entire structure and upper structure is automatically compared as requested by seismic codes.

## Cracked and Uncracked Sections In One Analysis
In-plane and out-of plane section properties can be modified in a very detailed manner. Cracked and uncracked section properties can be used in same analysis for different load cases.

## Vertical Earthquake Effects
Vertical earthquake effects are automatically taken into consideration and combined with other effects as required by the codes.

## Horizontal Irregularities
Floor Torsion, Extreme Floor Torsion, Diaphragm Discontinuity, Non-parallel systems are handled and required penalties are applied automatically.
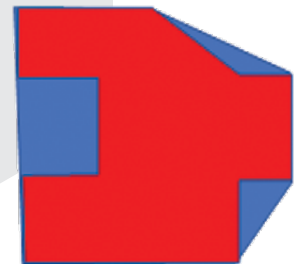


## Vertical Irregularities
Soft Storey, Extreme Soft Storey, Mass Irregularity, Vertical Geometric Irregularity, Weak Storey, Extreme Weak Storey are detected and penalties are automatically imposed.

## Analysis Method Selection
Analysis method validation is automatically done and user is warned whether static earthquake loading is applicable.



## Relative Storey Drift Check
Storey drifts are automatically checked against code regulations.

## Second Order Effects Check
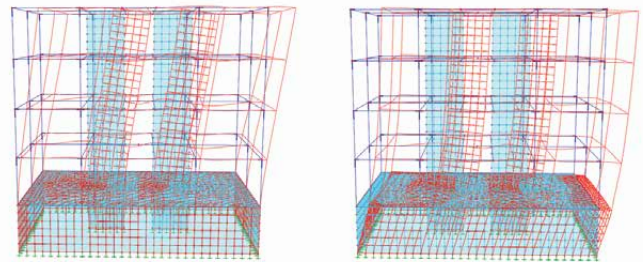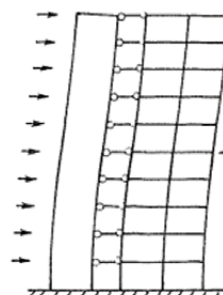Effect of structure's weight is automatically checked against storey shears.

## 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 EQS level and cumulative mass participation of modes is automatically checked.
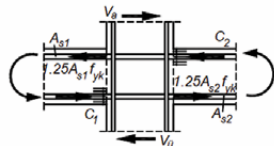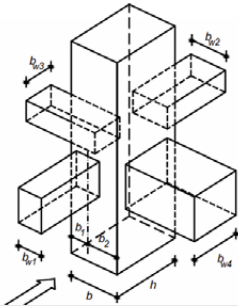
## Strong Column – Weak Beam Checks

Strong Column-Weak Beam checks are performed automatically to ensure that undesired failure mechanisms are prevented.
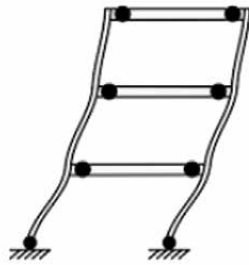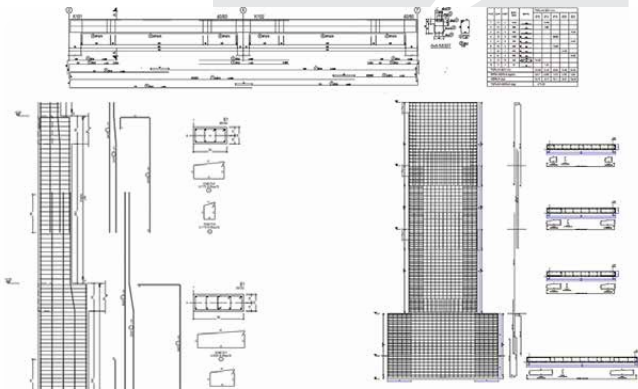


## Joint Shear Checks

Confined or unconfined joints are automatically checked against brittle failure.



## Ductile Member Design and Detailing

Columns, walls and beams are automatically designed to special ductility requirements. Automatic confinement zones, wall end-zones, design envelopes, capacity shears and much more are automatically considered.



## Diaphragm Modelling and Storey Meshing

Rigid diaphragms (single or multiple diaphragms on a floor), No Rigid Diaphrams, Flexible Diaphragms are automatically detected and taken care of. Storeys can be meshed selectively by using very detailed cracked section properties and load distribution options. Column outlines are also considered in the mesh.
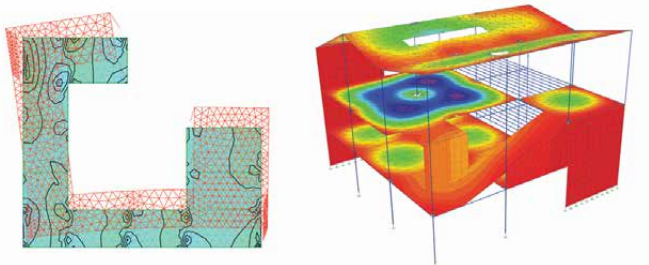


## Diaphragm Integrity and Load Transfer Checks

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

## Shearwall Modeling and Basement Walls

Midpier and shell models can be chosen for shearwall modelling. Dedicated tools can be used for corewalls and basement walls.

## Wall Coupling Beams

Special attention is required for coupling beams. Different cracked section properties can be used for coupling beams and ProtaStructure automatically checks for coupled-wall effectiveness.

## Seismic Isolators

You can insert different types of isolators anywhere on the structure for different seismic isolation scenarios.
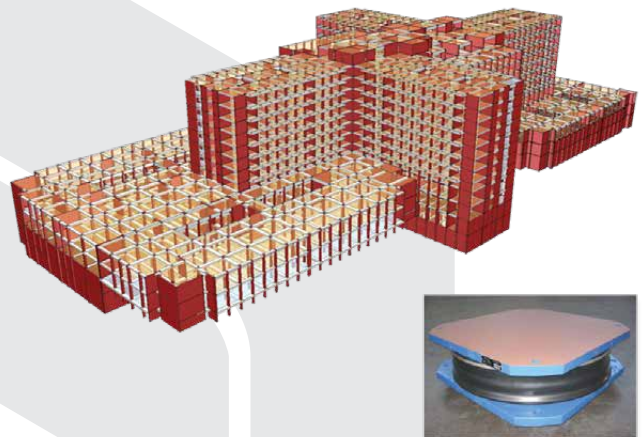


## Assessment and Retrofit of Existing Buildings

ProtaStructure supports different assessment techniques including linear elastic method, risk assessment method and nonlinear pushover analysis. You can retrofit the structure using inframe RC walls, column jacketting and steel braces.

## Pushover Analysis

Plastic hinges are automatically calculated and assigned to members. Performance point is automatically calculated and resulting plastic rotations are checked against code-specified limits for each member.
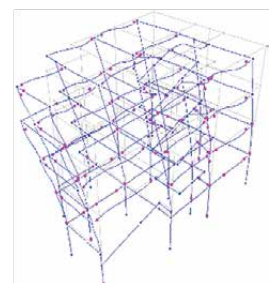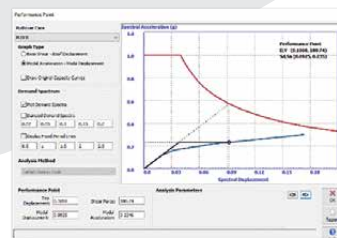


For more information on Prota's solutions please contact

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