PROJECT: ECOLOGICAL AND INNOVATIVE TECHNOLOGIES FOR RECOVERING INDUSTRIAL AREAS FROM LCA AND ENERGY EFFICIENCY POINT OF VIEW

2020-1-RO01-KA203-080223

USE OF A STRUCTURAL ANALYSIS SOFTWARE TO DETERMINE THE BEARING CAPACITY RESERVE FOR AN INDUSTRIAL BUILDING

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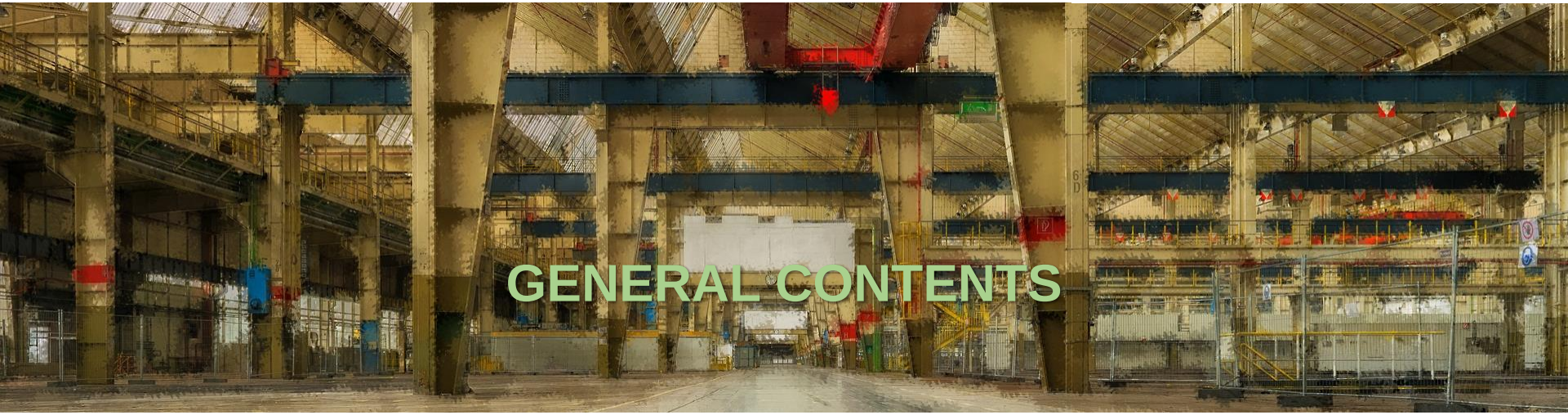

GENERAL CONTENTS

1. CHOICE AND INITIALIZATION OF THE STRUCTURAL ANALYSIS SOFTWARE

The choice of the structural analysis software with functions dedicated to the type of analysed/modelled structure

AXIS VM Structural Analysis & Design Software

SAP2000 ETABS

SCIA A NEMETSCHEK COMPANY

ADVANCE DESIGN

IDEA StatiCa® Calculate yesterday's estimates

cype

ProtaStructure®

Dlubal

Tekla® Structures

STAAD.Pro®

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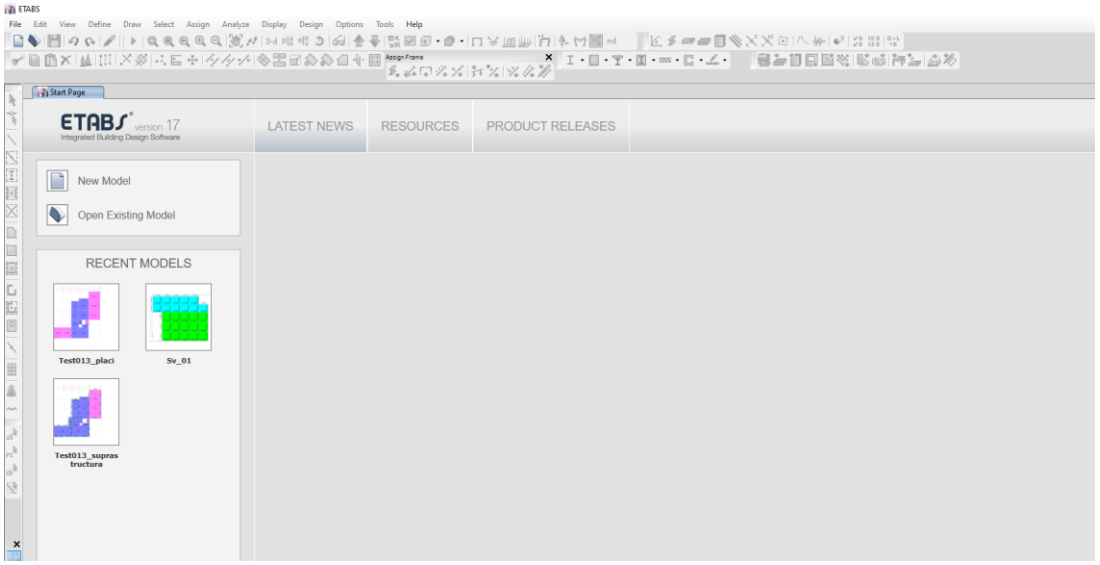
1. CHOICE AND INITIALIZATION OF THE STRUCTURAL ANALYSIS SOFTWARE

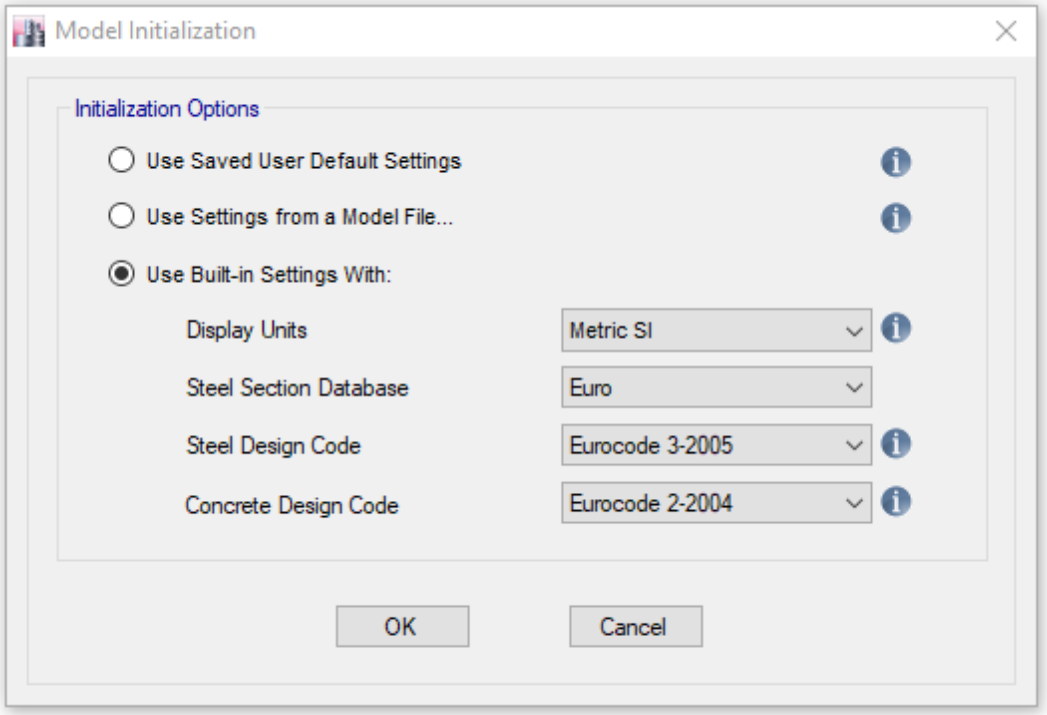
The advantage of using the ETABS software is the fact that it has a high degree of use at an international level.

SAP2000 | ETABS



Initialization of the structural analysis software ETABS

The initialization is done with the opening of a new model with the desired measurement units and the norms to be used.



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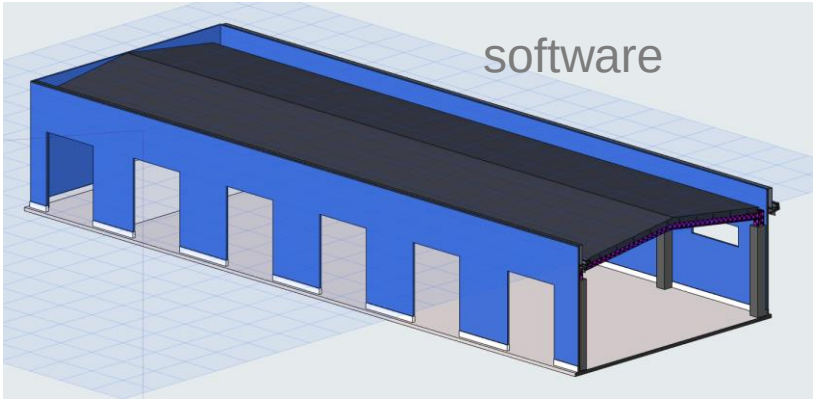
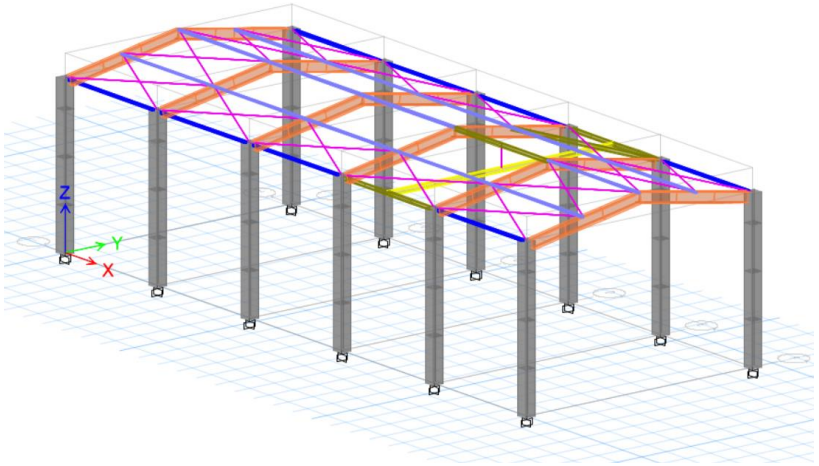
Initialization of the structural analysis software ETABS

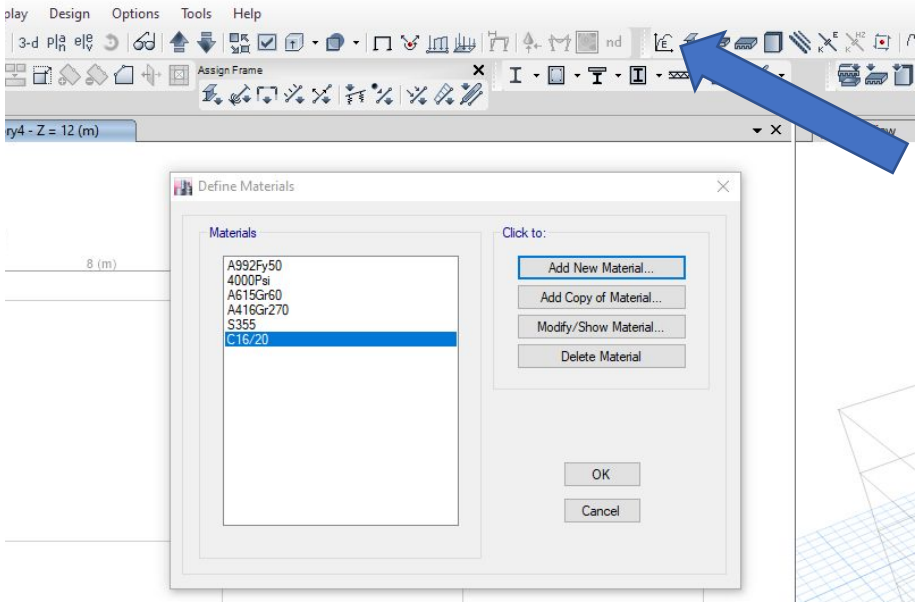
The geometry of the structure can be entered : - manual, point to point,
- by importing from BIM/CAD software





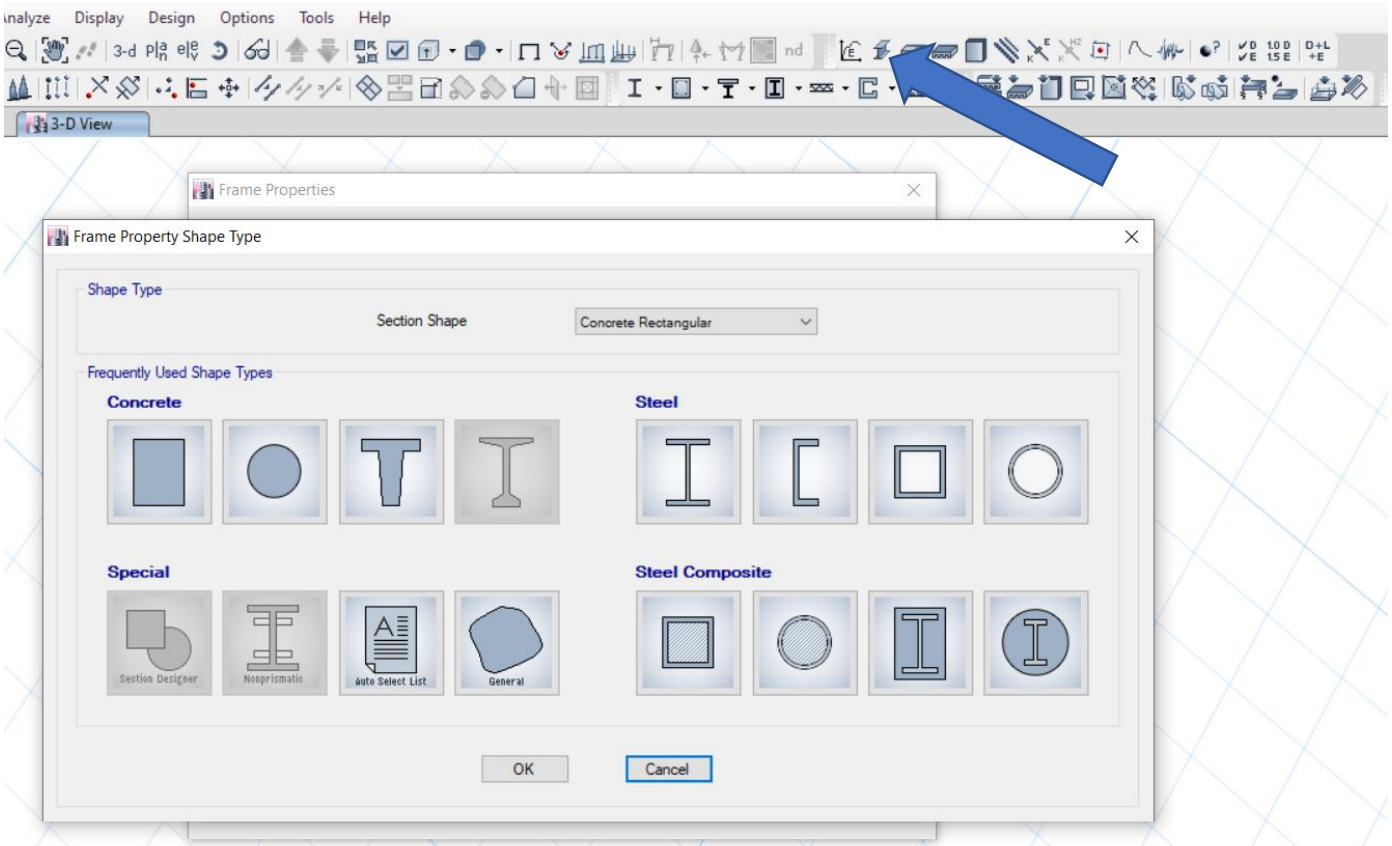
2. DEFINITION OF THE MATERIALS AND SECTIONS PROPERTIES

The definition of materials according to the results obtained through laboratory samples or in situ tests is done by accessing the menu program.



2. DEFINITION OF THE MATERIALS AND SECTIONS PROPERTIES

The next step is to define the cross-sections of the structural elements and the properties of the surface elements (reinforced concrete slabs, concrete diaphragms, etc.)



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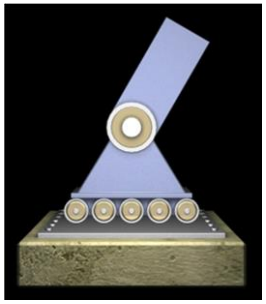
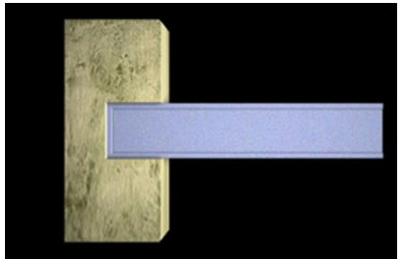
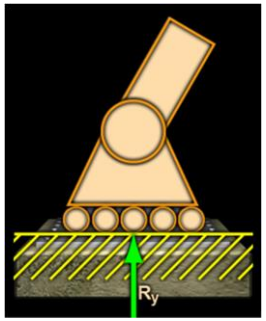
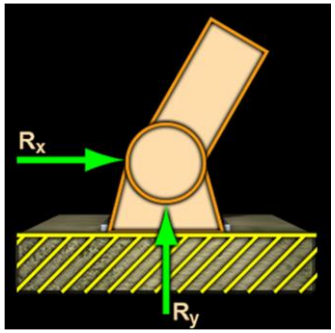
3. DEFINITION OF THE RESTRAINTS

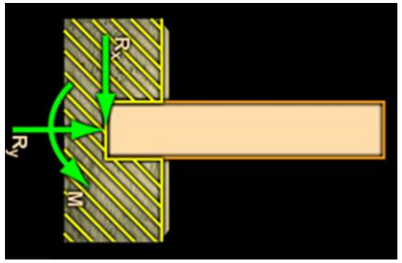
They can be: simple supported, pin or fixed.











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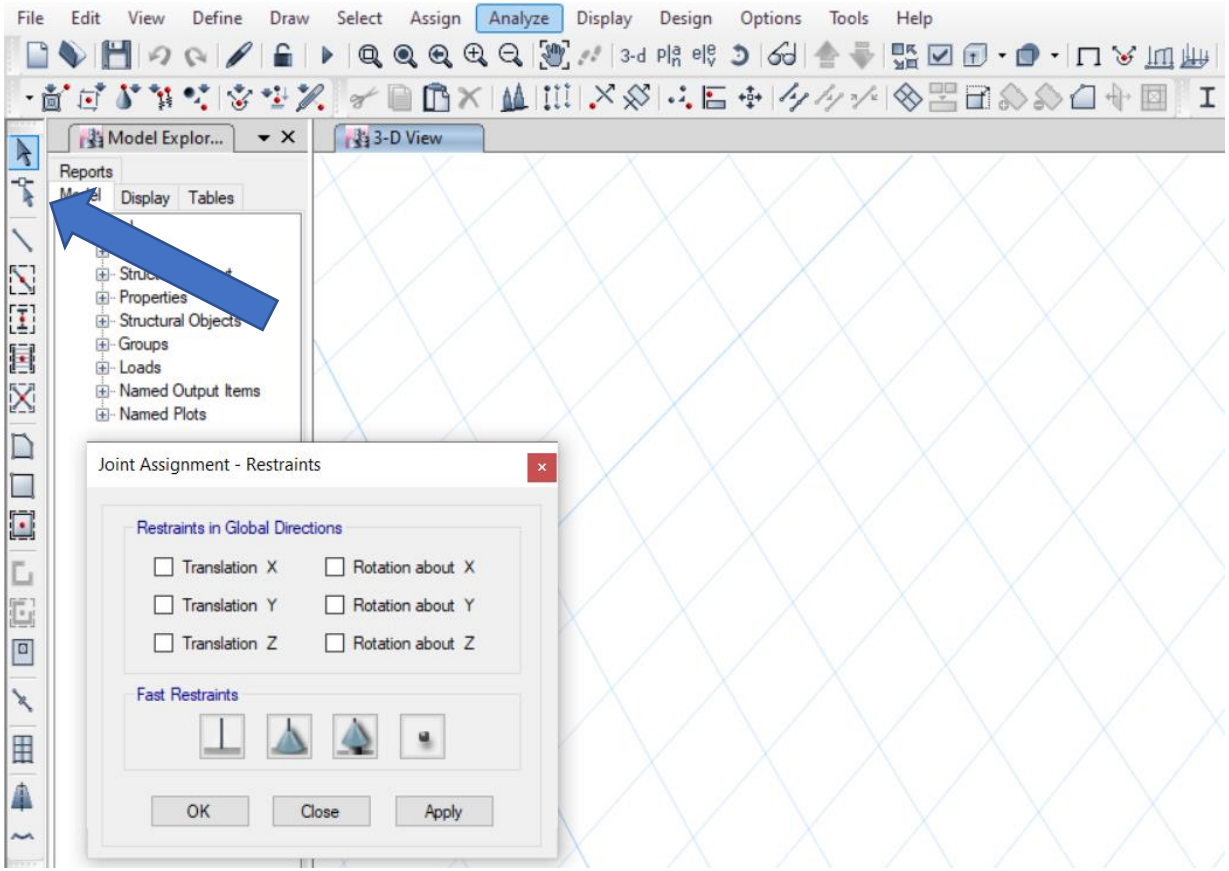
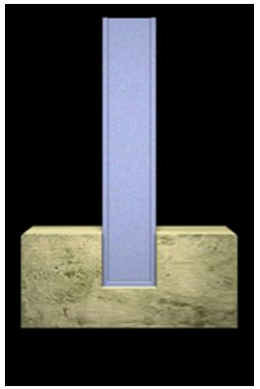
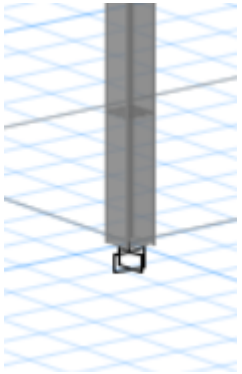




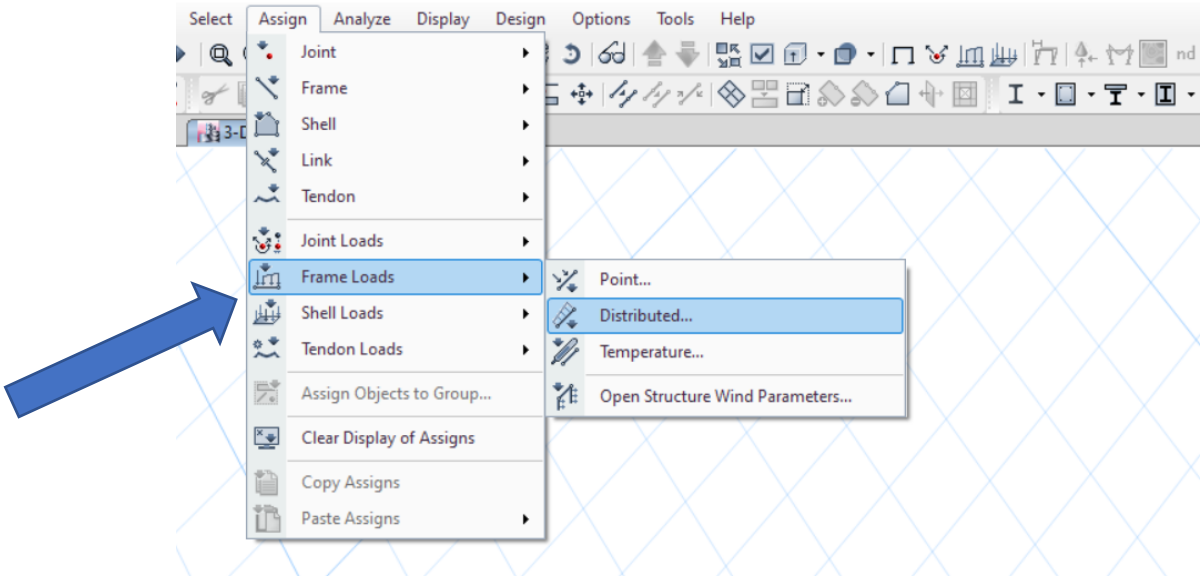


Modelling the column in the embedment type foundation

4. DEFINITION OF THE LOADS

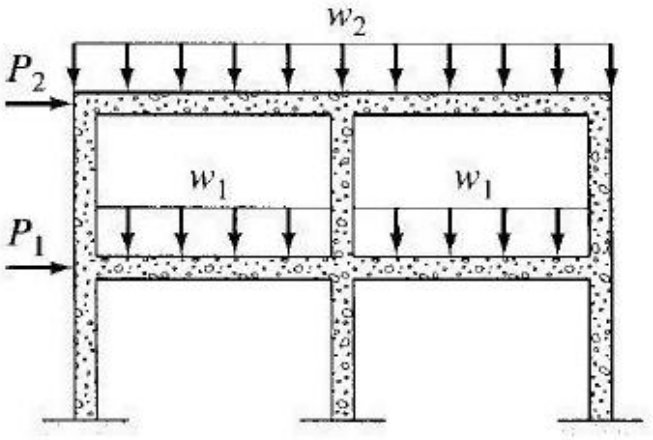
Evaluation of dead (permanent) loads :

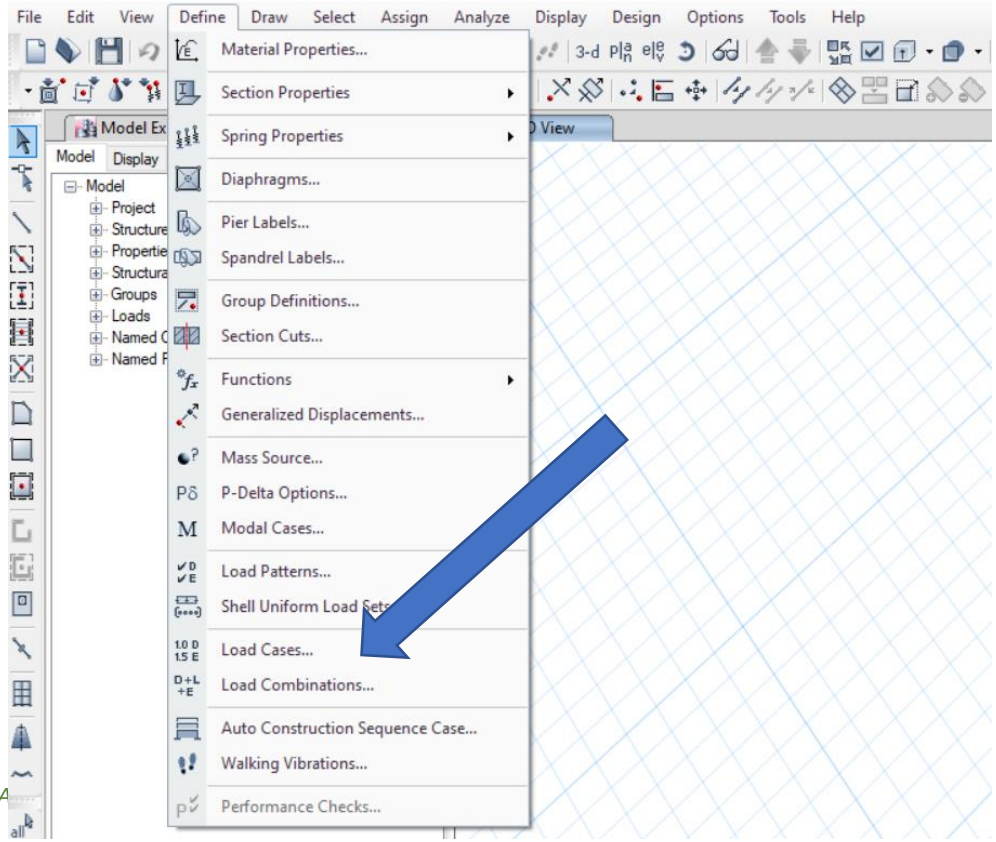
- ✓ Self weight of the structure,
- ✓ Own weight of the elements that are not in the calculation model



4. DEFINITION OF LOADS

- Evaluation of live loads :
  - occupants, furniture and other equipment
  - Environmental loads (wind and snow)
- Definition of accidental loads (earthquake load, etc)
- Establishing the load cases
- Definition of load combinations





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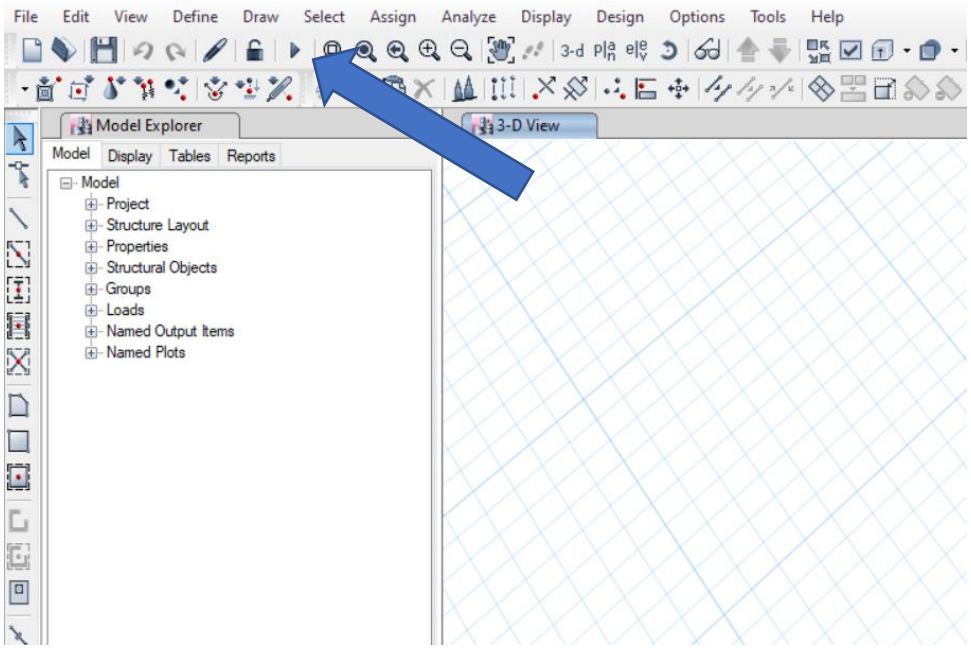
5. STRUCTURAL ANALYSIS

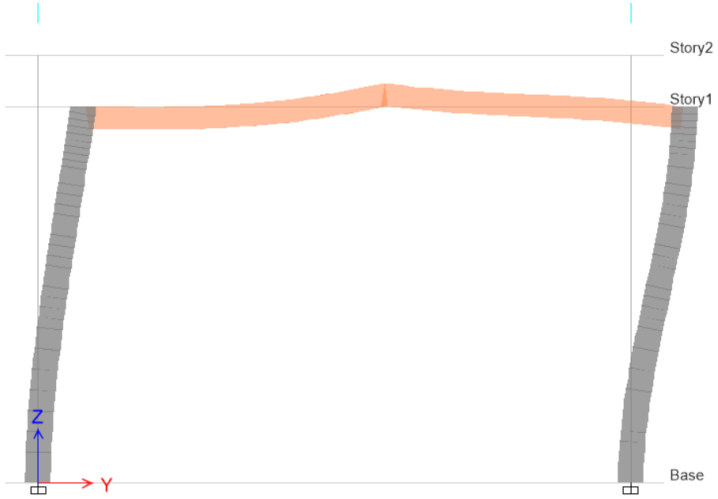
Global structural analysis by :

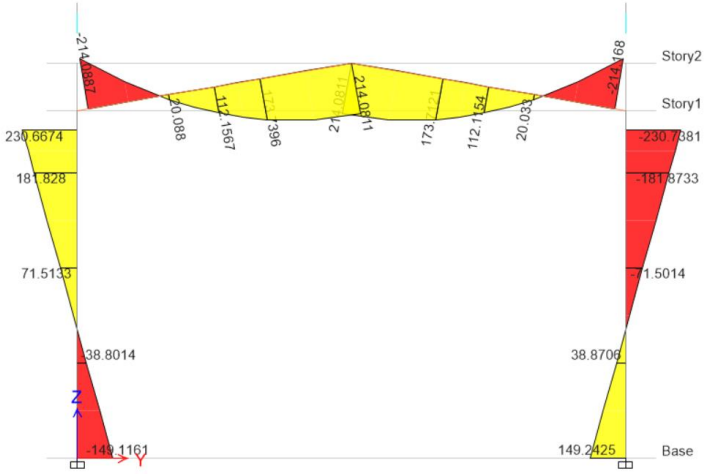
- ✓ Static calculation,
- ✓ Dynamic calculation.



6. INTERPRETATION OF THE RESULTS

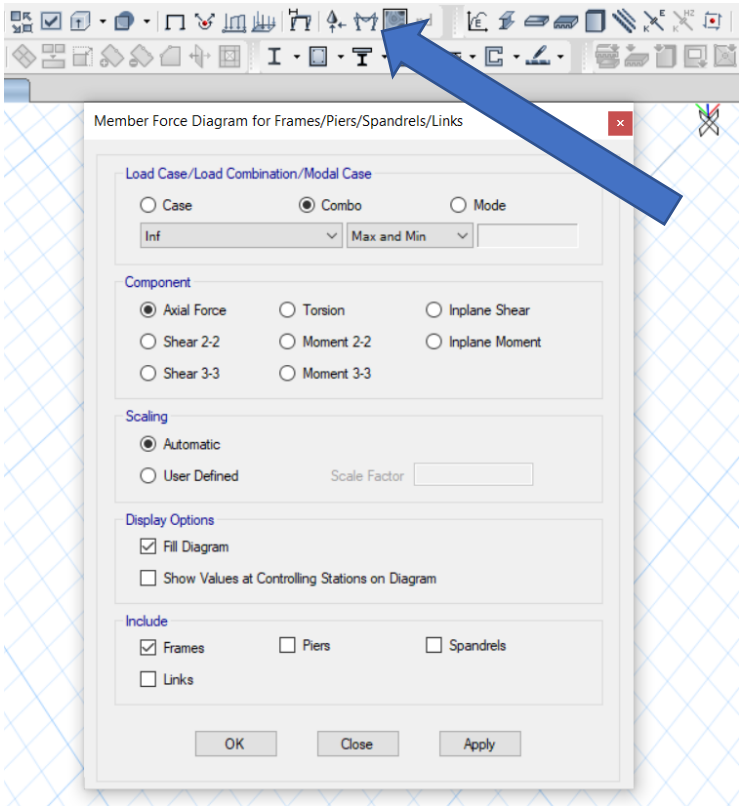
- Limit states - visualization of efforts and displacements
  - ✓ ULS
  - ✓ SLS
- Verification of efforts and displacements
- Checking drift (relative level shifts)





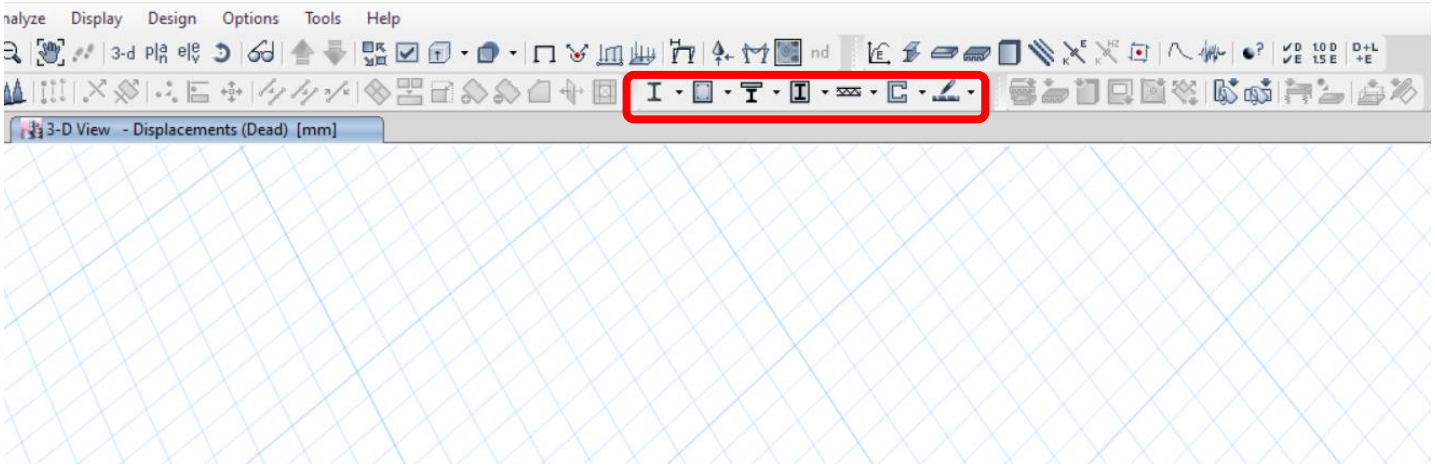
6. INTERPRETATION OF THE RESULTS

- Display of effort diagrams
- Iterative modification of the column and beam sections until the drift condition is met
- Verification of the dynamic characteristics of the structure (seismic participation mass, own vibration period of the structure, vibration modes, etc.)
- Sizing criteria (structure type, plastic or elastic analysis conditions, etc.)



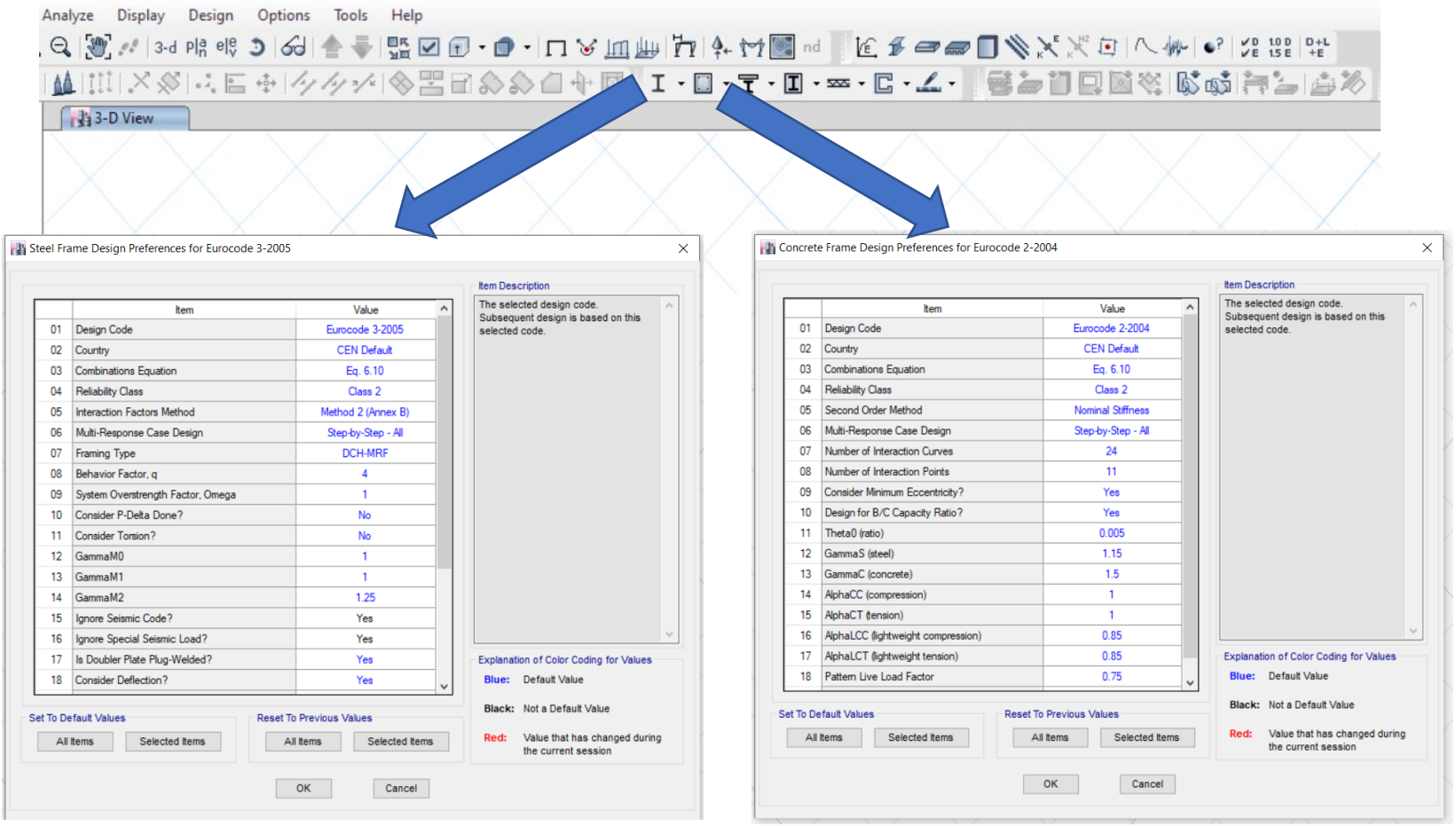
7. DETERMINATION OF BEARING CAPACITY

Using the dimensioning modules, the bearing capacity of structural elements can be determined:



7. DETERMINATION OF BEARING CAPACITY

- Reinforced concrete elements, steel, steel-concrete composite structures, reinforced concrete diaphragms can be dimensioned.



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8. DETERMINING THE DEGREE OF STRUCTURAL DAMAGE AND MAKING A DECISION

To quantify the degree of structural damage we refer to :

$$R = \frac{VALUE\ OF\ THE\ BEARING\ CAPACITY\ OF\ THE\ ELEMENT}{STRESS\ VALUE\ IN\ THE\ STRUCTURAL\ ELEMENT} x\ 100$$

The value of the degree of structural damage **R** is determined on the basis of a score assigned to each category of conditions for assessing the state of degradation of structural elements.

8. DETERMINING THE DEGREE OF STRUCTURAL DAMAGE AND MAKING A DECISION

- The value of the degree of structural damage **R**, can take values between 1 and 100,
- The value R = 100 corresponds to a structurally unaffected building.

$R<50$

Buildings susceptible to total or partial collapse

$50 \leq R < 70$

Buildings susceptible to moderate and/or medium damage

$70 \leq R$

Buildings which behave similarly to a building designed according to the technical regulations in force

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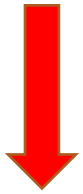
9. CONCLUSIONS

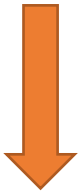
- A decision on demolition, strengthening or no structural intervention can be made on the basis of R:

$R<50$



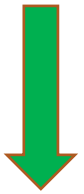
- ✓ DEMOLITION WITH MATERIAL RECYCLING

$50 \leq R < 70$



- ✓ CONSOLIDATION or
- ✓ DEMOLITION WITH RECOVERY OF MATERIALS

$70 \leq R$



- ✓ MAINTAINING THE ENTIRE STRUCTURE

REFERENCE

Introductory Tutorial-ETABS® 2020 Integrated Building Design Software-Computers & Structures, Inc

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