



**GRAITEC**  
**ADVANCE**  
THE STRUCTURAL BIM SUITE

# WHAT IS NEW in Grotec ADVANCE 2015

Advance Design

Advance CAD



[www.graitec.com](http://www.graitec.com)

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## Welcome to Advance Design 2015

Advance Design 2015 is fully part of the Graitec Advance suite composed by Advance CAD 2015 and Graitec BIM Connect 2015 (making possible files exchange and synchronization with Autodesk Revit ®).

GRAITEC Advance is linked also with Autodesk Advance Steel 2015 ® and Autodesk Advance Concrete 2015 ® in order to offer a Building Information Modeling (BIM) system that automates the entire structural design and construction documentation process from engineering design and structural analysis to member optimization, detailing and fabrication.



Advance Design 2015 is articulated around 3 main subjects:

- New options for the reinforced concrete design according EC2.
- A new starting screen for easier use and access.
- The implementation of the new NTC2008 Italian codes.

This release 2015 comes also with several small improvements and adjustments which are the feedback of thousands users:

- New appearance for icons
- Improvements on concrete design for planar elements with variable thickness
- Simplified reinforcement drawings for concrete beams and columns
- Update of the SRSS modal summation method for faster seismic analysis on simple models
- New solver option for improved torsion calculation on walls using T6-Q9 elements
- Improved export of a meshed model through a .TXT file format
- Uniform diagrams for linear support actions
- ...

Advance Design 2015 is the invaluable tool for all your projects.





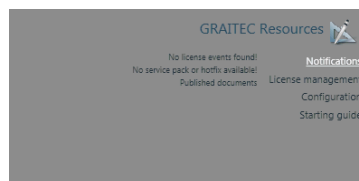
## New starting screen

Advance Design 2015 now comes with a brand-new starting wizard from where you can access a wealth of information: project samples, online videos, Graitec web site, existing projects...

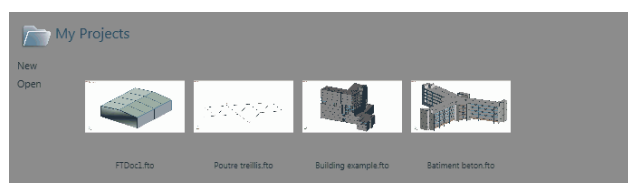


This new wizard is divided into several chapters:

- **GRAITEC Resources** enables users to manage their licenses and configure the application (language, design codes...):



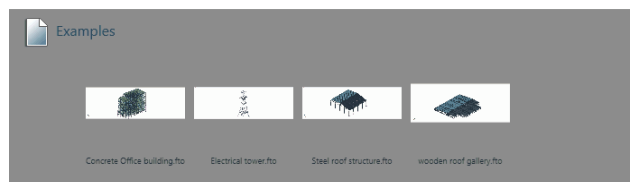
- **My Projects** gives access to recent models => the 4 most recently opened models are displayed as icons in this zone:



- **GRAITEC Advantages** provides links to the “member-only” area of our website, where user can find available useful material such as the latest service packs, as well as Frequently Asked Questions, and even ask their own questions to our technical team through our forum.



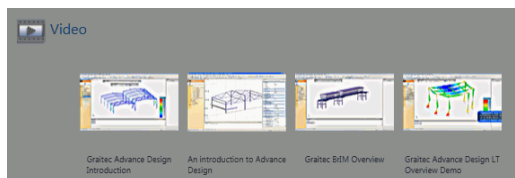
- **Examples** shows a set of interesting projects for our customers who wish to get familiar with advanced modeling and results post processing in Advance Design. The example models are different for each country (depending on the settings of the configuration dialog):



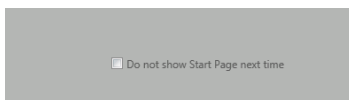
- **Online** will take users to our website for the latest news about our company as well as outstanding projects achieved by our customers, and useful links to social applications:



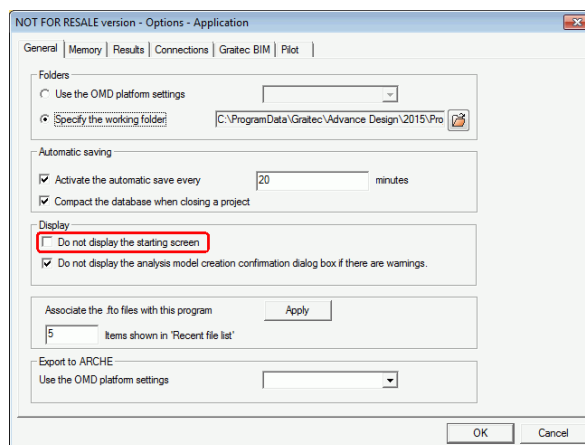
- **Video** enables users to play the latest Advance Design movies such as tutorials, webinars .... showing the entire range of software capabilities



The bottom right part of the starting screen lets users disable this wizard:



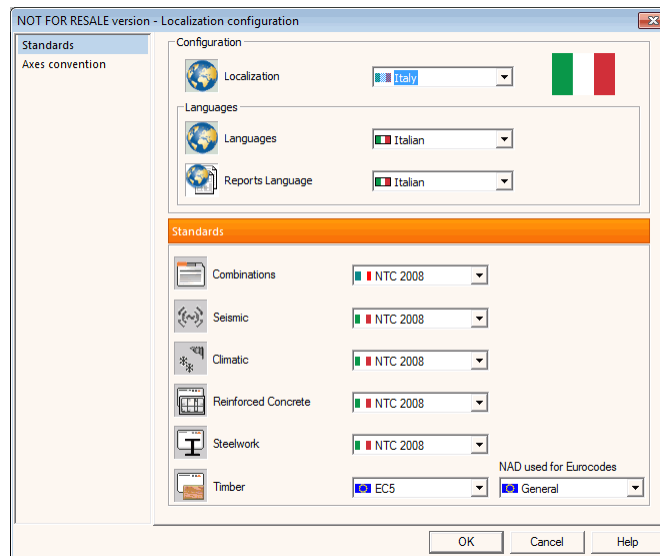
Of course, this setting can be changed any time from the **Options - Application** menu:



## Localization: Italian codes NTC2008

Advance Design 2015 now features the NTC 2008 Italian codes for:

- Actions combinations automatic generation
- Seismic loads
- Climatic loads (Wind & Snow)
- Reinforced concrete design
- Steel members design



As we can see here above, choosing “Italy” for the **Country** setting will automatically activate the Italian design codes.

## Actions & combinations

Advance Design 2015 is now able to handle the requirements from NTC 2008 regarding:

- Live load categories
- Combination categories
- ULS combinations
- SLS combinations

NTC 2008 codes differ from general Eurocodes in the way that the STR (structural) and GEO (geotechnical) ULS combinations differ from each other, having different factoring coefficients, as detailed in the following table:

Tabella 2.6.1 – Coefficienti parziali per le azioni o per l'effetto delle azioni nelle verifiche SLU

		Coefficiente $\gamma_f$	EQU	A1 STR	A2 GEO
Carichi permanenti	favorevoli	$\gamma_{G1}$	0,9	1,0	1,0
	sfavorevoli		1,1	1,3	1,0
Carichi permanenti non strutturali <sup>(1)</sup>	favorevoli	$\gamma_{G2}$	0,0	0,0	0,0
	sfavorevoli		1,5	1,5	1,3
Carichi variabili	favorevoli	$\gamma_{Q1}$	0,0	0,0	0,0
	sfavorevoli		1,5	1,5	1,3

<sup>(1)</sup>Nel caso in cui i carichi permanenti non strutturali (ad es. carichi permanenti portati) siano compiutamente definiti si potranno adottare per essi gli stessi coefficienti validi per le azioni permanenti.

This results in Advance Design 2015 providing two separated buttons to manage these STR & GEO combinations instead of one common button, in the simplified combinations dialog:

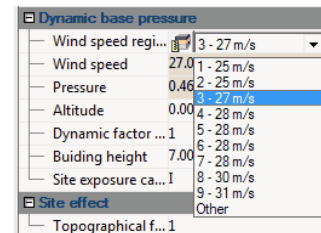
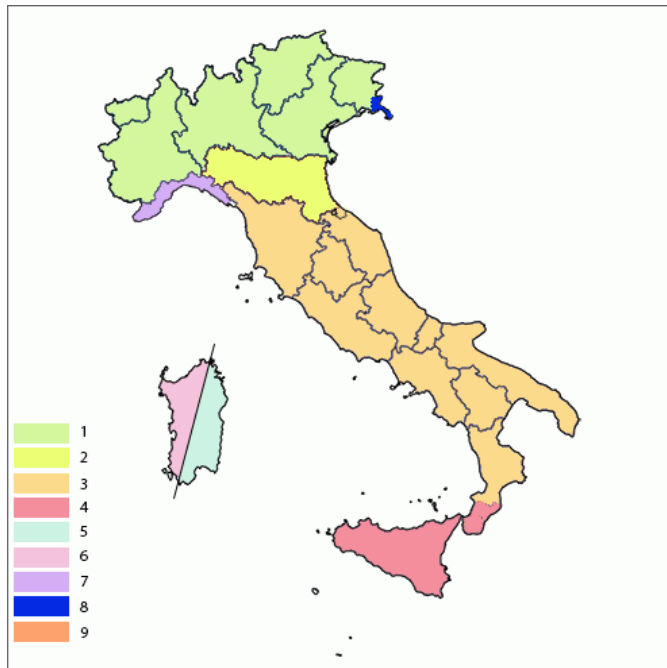
## Climatic loads - Wind

The climatic generator from Advance Design 2015 now meets the requirements from NTC 2008 regarding **wind load cases**.

Those new parameters are available in the updated property list of the NTC2008 wind loads family:

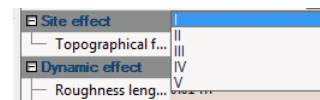


- New Italian map for the “Base reference wind pressure” (NTC2008 – Table 3.3.I):

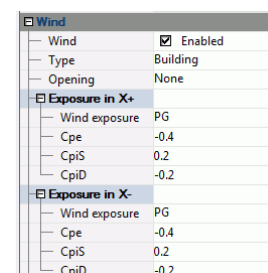
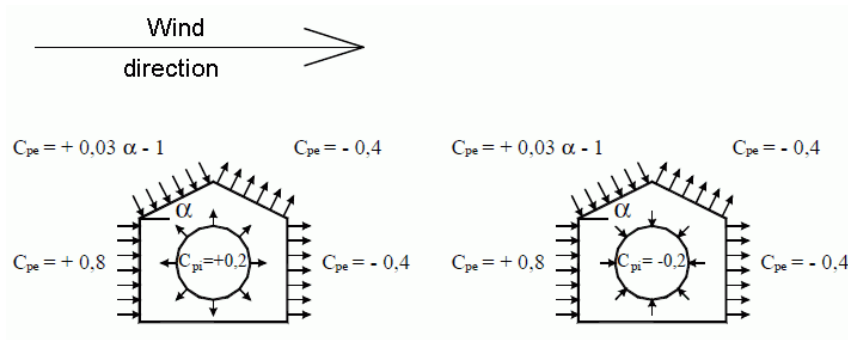


- Ground categories definition (NTC2008 – Table 3.3.II)

Categoria di esposizione del sito	$k_r$	$z_0$ [m]	$z_{min}$ [m]
I	0,17	0,01	2
II	0,19	0,05	4
III	0,20	0,10	5
IV	0,22	0,30	8
V	0,23	0,70	12



- Pressure coefficients ( $C_{pe}$  &  $C_{pi}$ ) calculated automatically (NTC2008 - §3.3.3) keeping the possibility to impose them on some specific cases:



## Climatic loads - Snow

The snow loads family property list has also been updated according to the NTC 2008:

**Properties**

All properties

**Family**

- Name: Snow NTC-2008
- No: 8

**Snow category**

- Category: Altitude < 1000 m a.s.l.

**Combinations**

- Group loads: ☐ Disabled
- Effect: Leading or Accompanyi...
- Coefficient  $\gamma_{\text{EQU}}$ : 1.5
- Coefficient  $\gamma_{\text{STR}}$ : 1.5
- Coefficient  $\gamma_{\text{GEO}}$ : 1.5
- $\Psi_0$  coefficient: 0.5
- $\Psi_1$  coefficient: 0.2
- $\Psi_2$  coefficient: 0

**Color**

- Color: Water blue

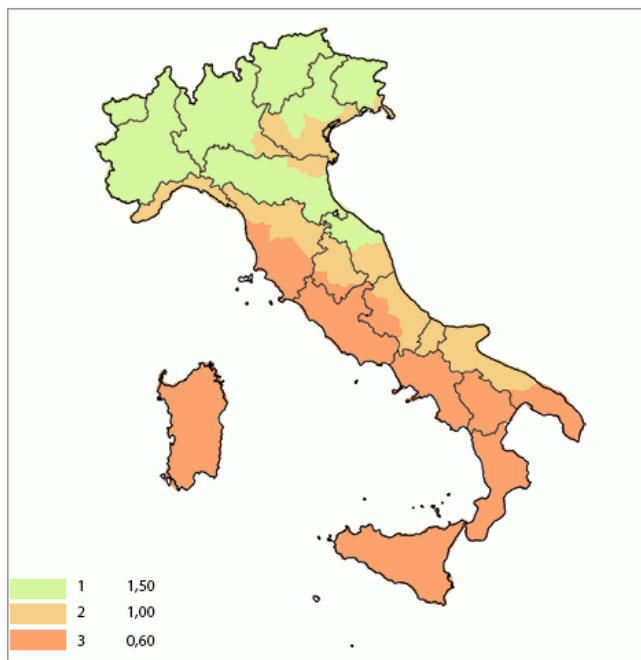
**Situation of the project**

- Exceptional snow ...: ☐ Disabled
- Exceptional snow ...: ☒ Enabled

**Parameters**

- Typical value: I Alpina
- Snow load: 1.50 kN/m<sup>2</sup>
- Exceptional snow ...: 0.00 kN/m<sup>2</sup>
- Exposure factor: Normal location
- Thermal factor: 1
- Altitude: 0.00 m

- New Italian map for the Snow regions definition (NTC2008 - §3.4.1)



**Parameters**

- Typical value: I Alpina
- Snow load: 1.50
- Exceptional snow ...: 0.00
- Exposure factor: Nor
- Thermal factor: 1
- Altitude: 0.00 m

- Ground categories definition (NTC2008 – Table 3.4.I):

Topografia	Descrizione	C <sub>E</sub>
Battuta dai venti	Aree pianeggianti non ostruite esposte su tutti i lati, senza costruzioni o alberi più alti.	0,9
Normale	Aree in cui non è presente una significativa rimozione di neve sulla costruzione prodotta dal vento, a causa del terreno, altre costruzioni o alberi.	1,0
Riparata	Aree in cui la costruzione considerata è sensibilmente più bassa del circostante terreno o circondata da costruzioni o alberi più alti	1,1

- Roof shape's factor (NTC2008 – §3.4):

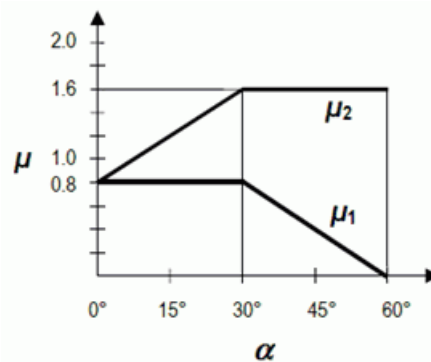


Figura C3.4.1: Coefficienti di forma per il carico neve

When activating the automatic generation of climatic loads, the user can access a report with the main results for wind and snow actions:

NOT FOR RESALE version - Report Generator

Document | Table | Post-processing | Curve | Views | Other

Finite Elements Analysis  
Geometrical data  
Loading data  
Description of climatic loads  
Description of global actions  
Description of load cases and families

**GRAITEC** Project: 01/13/20

**Description of climatic loads**

**Structure properties**

Structure properties	Value
Building height	h = 8.00 m
Building length	l = 24.00 m
Building width	w = 24.00 m

**Structure description: Walls**

Structure description: Walls	Coordinates	Roof height	Roof width
Vertical wall 1	(20.00, 24.00, 0.00) (20.00, 24.00, 5.00) (20.00, 0.00, 5.00) (20.00, 0.00, 0.00)	5.00	24.00
Vertical wall 2	(0.00, 24.00, 0.00) (0.00, 24.00, 5.00) (0.00, 0.00, 5.00) (0.00, 0.00, 0.00)	5.00	24.00
Vertical wall 3	(0.00, 0.00, 0.00) (20.00, 0.00, 0.00) (20.00, 0.00, 5.00) (10.00, 0.00, 5.00) (10.00, 0.00, 0.00)	6.00	20.00
Vertical wall 4	(0.00, 24.00, 0.00) (20.00, 24.00, 0.00) (20.00, 24.00, 5.00) (10.00, 24.00, 5.00) (10.00, 24.00, 0.00)	6.00	20.00

**Structure description: Roofs**

Structure description: Roofs	Coordinates	Roof height	Roof width	g	s <sub>1</sub>	s <sub>2</sub>
Roof 1	(10.00, 24.00, 0.00) (10.00, 0.00, 0.00) (20.00, 0.00, 0.00) (20.00, 24.00, 0.00)	10.00	24.00	5.71	5.00	6.00

**Wind characteristics**

Wind characteristics

Wind characteristics	Value
Direction	All directions
Wind region	II - 25 m/s
Fundamental value of the basic wind velocity	v <sub>b</sub> = 25 m/s
Exposure factor	1.00
Topographic factor	1.00
Basic velocity pressure	0.59 kN/m²
Exposure factor	2.00
Permeable windwalls	

**Snow characteristics**

Snow characteristics

Snow characteristics	Value
Snow region	II - Alps
Snow pressure	1.20 kN/m²
Exceptional snow factor	0.00 kN/m²
Exposure factor	1.00
Thermal factor	1.00
Altitude	0.00 m

**Dynamic pressure: Walls**

Dynamic pressure: Walls

v<sub>w</sub> - Basic Wind Velocity

v<sub>w</sub> = v<sub>b</sub> \* (k<sub>1</sub> \* (k<sub>2</sub> - k<sub>3</sub>))    k<sub>1</sub> <= k<sub>2</sub>    k<sub>2</sub> < k<sub>3</sub> <= 1500m

c<sub>w</sub>(z) - Exposure factor

c<sub>w</sub>(z) = k<sub>z</sub>² \* C<sub>s</sub> \* ln(z / z<sub>0</sub>) \* [ 7 + c<sub>s</sub> \* ln(z / z<sub>0</sub>) ]    z >= z<sub>min</sub>

q<sub>w</sub> - Basic velocity pressure

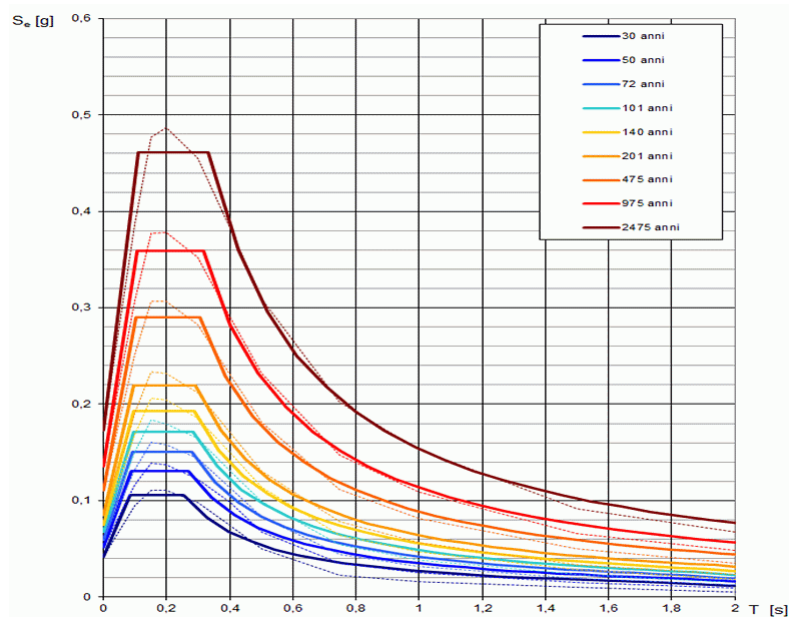
q<sub>w</sub> = 0.5 \* 1.25 \* v<sub>w</sub>²

q<sub>w</sub>(z) - Peak velocity pressure at a height

q<sub>w</sub>(z) = c<sub>w</sub>(z) \* q<sub>w</sub> \* C<sub>pe</sub>

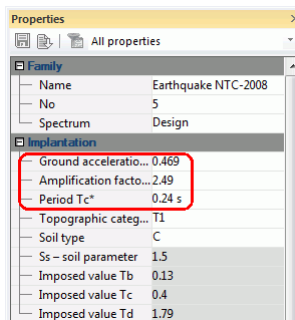
## Seismic analysis

Advance Design 2015 is now able to generate the seismic spectrum related to the NTC 2008.



Property sheet of the NTC2008 seismic load family will provide the three fundamental parameters:

- $a_g \rightarrow$  max ground acceleration (horizontal)
- $F_0 \rightarrow$  amplification factor
- $T_c^* \rightarrow$  period of the initial part of the spectrum with  $v$  constant.

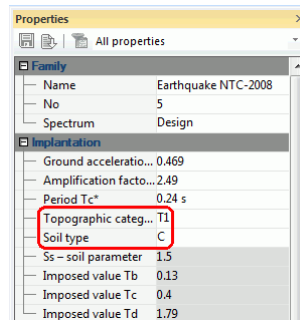


Ground category can also be defined by user:

Categoria	Descrizione
A	Ammassi rocciosi affioranti o terreni molto rigidi caratterizzati da valori di $V_{s,30}$ superiori a 800 m/s, eventualmente comprendenti in superficie uno strato di alterazione, con spessore massimo pari a 3 m.
B	Rocce tenere e depositi di terreni a grana grossa molto addensati o terreni a grana fina molto consistenti con spessori superiori a 30 m, caratterizzati da un graduale miglioramento delle proprietà meccaniche con la profondità e da valori di $V_{s,30}$ compresi tra 360 m/s e 800 m/s (ovvero $N_{SPT,30} > 50$ nei terreni a grana grossa e $c_{u,30} > 250$ kPa nei terreni a grana fina).
C	Depositi di terreni a grana grossa mediamente addensati o terreni a grana fina mediamente consistenti con spessori superiori a 30 m, caratterizzati da un graduale miglioramento delle proprietà meccaniche con la profondità e da valori di $V_{s,30}$ compresi tra 180 m/s e 360 m/s (ovvero $15 < N_{SPT,30} < 50$ nei terreni a grana grossa e $70 < c_{u,30} < 250$ kPa nei terreni a grana fina).
D	Depositi di terreni a grana grossa scarsamente addensati o di terreni a grana fina scarsamente consistenti, con spessori superiori a 30 m, caratterizzati da un graduale miglioramento delle proprietà meccaniche con la profondità e da valori di $V_{s,30}$ inferiori a 180 m/s (ovvero $N_{SPT,30} < 15$ nei terreni a grana grossa e $c_{u,30} < 70$ kPa nei terreni a grana fina).
E	Terreni dei sottosuoli di tipo C o D per spessore non superiore a 20 m, posti sul substrato di riferimento (con $V_s > 800$ m/s).

The user will define the **topographic category**, which considers the shape of the construction site (plane area, slopes etc.) depending on the inclination.

Categoria	Caratteristiche della superficie topografica
T1	Superficie pianeggiante, pendii e rilievi isolati con inclinazione media $i \leq 15^\circ$
T2	Pendii con inclinazione media $i > 15^\circ$
T3	Rilievi con larghezza in cresta molto minore che alla base e inclinazione media $15^\circ \leq i \leq 30^\circ$
T4	Rilievi con larghezza in cresta molto minore che alla base e inclinazione media $i > 30^\circ$



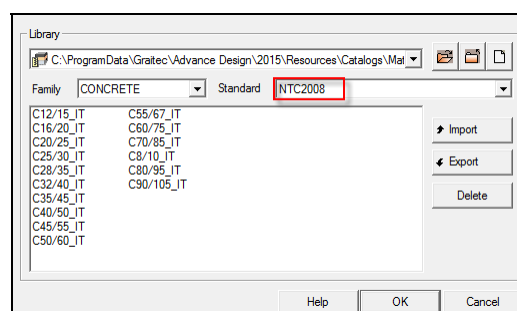
## Reinforced concrete design

The design engine for concrete elements, when set on Italian settings, is now able to handle the following checks, according to the NTC 2008 codes:

- Material properties
- Tension design
- Simple and composed bending design
- Shear and torsion effects
- Detailed beams check
- Column design
- Plate reinforcement design
- Plate cracks check
- Deflection calculation

### Material properties

A new reinforced concrete materials library is available according to the NTC 2008:



## **Creep coefficient**

Specific calculation of creep coefficient was implemented, according the following tables:

**Tabella 11.2.VI – Valori di  $\phi(\infty, t_0)$ . Atmosfera con umidità relativa di circa il 75%**

$t_0$	$h_0 \leq 75 \text{ mm}$	$h_0 = 150$	$h_0 = 300$	$h_0 \geq 600$
3 giorni	3,5	3,2	3,0	2,8
7 giorni	2,9	2,7	2,5	2,3
15 giorni	2,6	2,4	2,2	2,1
30 giorni	2,3	2,1	1,9	1,8
$\geq 60$ giorni	2,0	1,8	1,7	1,6

**Tabella 11.2.VII - Valori di  $\phi(\infty, t_0)$ . Atmosfera con umidità relativa di circa il 55%**

$t_0$	$h_0 \leq 75 \text{ mm}$	$h_0 = 150$	$h_0 = 300$	$h_0 \geq 600$
3 giorni	4,5	4,0	3,6	3,3
7 giorni	3,7	3,3	3,0	2,8
15 giorni	3,3	3,0	2,7	2,5
30 giorni	2,9	2,6	2,3	2,2
$\geq 60$ giorni	2,5	2,3	2,1	1,9

Per valori intermedi è ammessa una interpolazione lineare.

Nel caso in cui sia richiesta una valutazione in tempi diversi da  $t = \infty$  del coefficiente di viscosità questo potrà essere valutato secondo modelli tratti da documenti di comprovata validità.

## **Crack width**

Crack width depends on environment conditions and reinforcement sensibility:

CONDIZIONI AMBIENTALI	CLASSE DI ESPOSIZIONE
Ordinarie	X0, XC1, XC2, XC3, XF1
Aggressive	XC4, XD1, XS1, XA1, XA2, XF2, XF3
Molto aggressive	XD2, XD3, XS2, XS3, XA3, XF4

## **Steel design**

The design engine for steel elements, when set on Italian settings, is now able to handle the following checks, according to the NTC 2008 codes:

- New libraries for cross sections and materials;
- Updated loads combination engine;
- Sections classification;
- Steel members design.

Compared to EN1993-1-1, main adjustment was related to safety coefficients for member resistance, member stability, fire calculation and joint design:

Resistenza delle Sezioni di Classe 1-2-3-4	$\gamma_{M0} = 1,05$
Resistenza all'instabilità delle membrature	$\gamma_{M1} = 1,05$
Resistenza all'instabilità delle membrature di ponti stradali e ferroviari	$\gamma_{M1} = 1,10$
Resistenza, nei riguardi della frattura, delle sezioni tese (indebolite dai fori)	$\gamma_{M2} = 1,25$



## Deflection calculation on concrete elements

### Theory

When doing a FEM analysis, the user has the possibility to post process the FEM displacements, which are taking into account a full concrete inertia. For example, on a beam with a rectangular section R30\*70cm, the

considered inertia will be:  $I = \frac{b \cdot h^3}{12} = \frac{0.30 \times 0.70^3}{12} = 0.008575m^4$ .

The issue is that this kind of calculation does not take into account the cracked inertia of a reinforced concrete section.

Since the release 2012 of Advance Design, the user has had the possibility of imposing, in the property list of linear and planar elements, a global "Cracked inertia" coefficient for each element, which affects the FEM value:

Thickness	
1st vertex	20.00 cm
Slope x	0
Slope y	0
Concrete inertia type	Auto value
Cracked section inertia c...	0.722

With this new feature, we will see that the user can activate the automatic calculation of this cracked inertia coefficient (this is explained further below).

Regarding the total concrete deflections, §7.4.3 from EN1992-1-1 specifies an interpolation between a non-cracked status  $\alpha_I$  and a fully cracked status  $\alpha_{II}$ .

This interpolation has to be done according the formula (7.18) from the EC2:

$$\alpha = \zeta \alpha_{II} + (1 - \zeta) \alpha_I \quad \dots (7.18)$$

Where the  $\zeta$  interpolation coefficient is defined by the formula (7.19):

$$\zeta = 1 - \beta \left( \frac{\sigma_{sr}}{\sigma_s} \right)^2 \quad \dots (7.19)$$

The  $\beta$  value depends on the duration of the loads => this assumption is coming from the combinations definition in Advance Design:

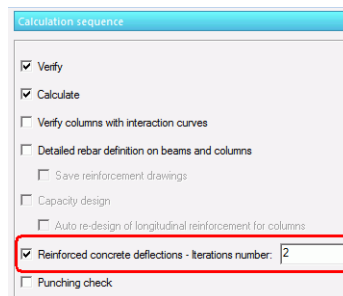
- For "Short duration" loads =>  $\beta=1.00$
- For "Long duration" loads =>  $\beta=0.50$

In Advance Design, we consider always  $\beta=0.50$  because we check the deflections under quasi-permanent combinations.

The stress value  $\sigma_s$  is calculated considering the real reinforcement on linear and planar elements.

The calculation of the reinforced concrete deflections is an iterative process:

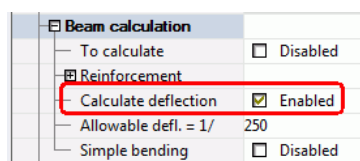
- Step 1 => 1<sup>st</sup> FEM calculation considering the “full” concrete inertia in order to get the internal forces.
- Step 2 => Concrete design step, including the cracked inertia and interpolated inertia coefficient calculation, considering either the calculated reinforcement quantities, either considering the values imposed by the user.
- Step 3 => New FEM calculation considering the cracked inertia values.
- Step 4 => New Concrete design step considering the new FEM forces distribution.
- Step “n” => The previous steps can be reproduced “n” times depending on a user parameter available from the concrete assumptions dialog:



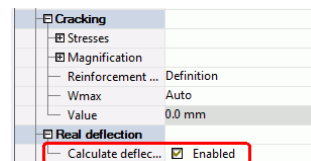
## User interface & results post processing

### Parameters definition

To activate this new functionality, the user has access to a new “Calculate deflection” option available in the element property lists, for linear and planar elements:



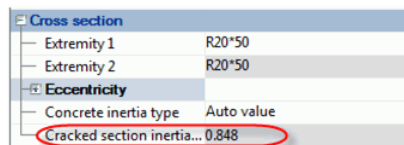
*Linear elements*



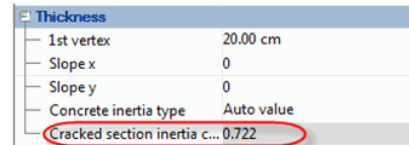
*Planar elements*

As we saw before, for even greater accuracy the user can run several iterations: the inertia given by a first concrete design step will impact the internal forces given in a second finite element analysis, thus leading to new results for reinforcement and inertia, impacting again on the internal forces...

At the end of each iteration, Advance Design will store the interpolated cracked inertia coefficients for linear and planar elements.



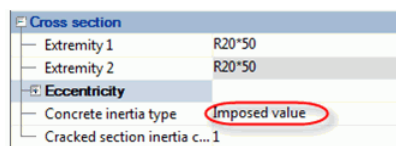
*Linear elements*



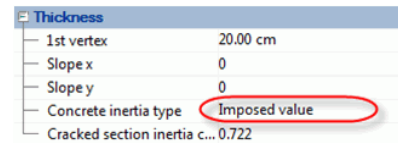
*Planar elements*

So, it means that at the end of the defined number of iterations, the user will have the possibility of post processing all FEM results (including displacements) calculated with cracked inertias.

Of course, the user still has the ability to enter a fixed value for concrete inertia:



*Linear elements*



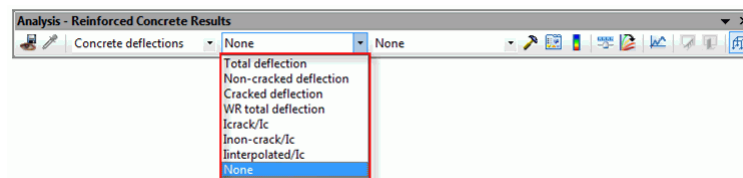
*Planar elements*

### Results post processing on linear elements.

At the end of the concrete design process, the user will have access to a new entry, "Concrete deflections", in the concrete results combo list.

The results available to be post-processed are different for linear and planar elements.

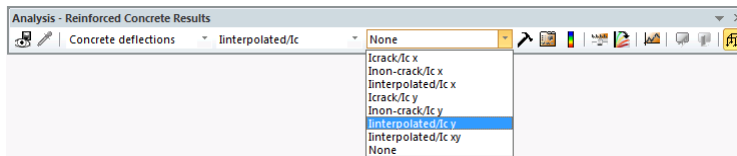
- On linear elements:



- "Total deflection" => this option displays the total deflection, on each mesh, calculated with the EC2 interpolation formula.
- "Non-cracked deflection" => deflection calculated with the non-cracked inertia.
- "Cracked inertia" => deflection calculated with the full cracked inertia.
- "WR total deflection" => Working Ratio for the calculated deflection, depending on the maximum allowable value imposed by the user.
- "lcrack/lc" => Ratio between the fully cracked inertia and the concrete inertia  $I_c$ .
- "lnon-crack/lc" => Ratio between the non-cracked inertia and the concrete inertia  $I_c$ .
- "linterpolated/lc" => Ratio between the interpolated inertia and the concrete inertia  $I_c$ .

## **Results post processing on planar elements**

On planar elements, the available results are:



We see that the results are almost the same ones as for linear elements, with some few differences:

- The inertias are given per direction, depending on the local axes:
  - The inertias  $I_x$  are used to calculate the internal forces and corresponding reinforcement values  $A_{yi}$  and  $A_{ys}$ .
  - The inertias  $I_y$  are used to calculate the internal forces and corresponding reinforcement values  $A_{xi}$  and  $A_{xs}$ .
- We see that we can post process the average values for inertia (x,y) => when updating the inertia for the FEM calculation (in case of several steps defined by the user), the software is defining one value per mesh, the same value on the two local directions x and y. The calculation of this average value is detailed here below.

## **Calculation of the “average” inertia on planar elements**

We just saw here above that Advance Design calculates the concrete inertias per local direction, having then two values per mesh.

Then, for the next FEM step, Advance Design calculates an average inertia coefficient per mesh, considering:

- The calculated or imposed reinforcement values on x local direction =>  $A_x = (A_{xi} + A_{xs})$
- The calculated or imposed reinforcement values on y local direction =>  $A_y = (A_{yi} + A_{ys})$
- We associate to  $A_x$  the inertia  $I_{y,interpolated}$ .
- We associate to  $A_y$  the inertia  $I_{x,interpolated}$ .

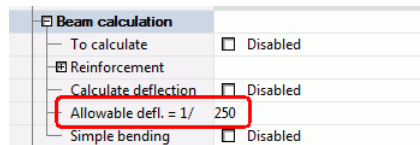
- Then, we calculate the average inertia => 
$$I = \frac{A_x}{(A_x + A_y)} \times I_y + \frac{A_y}{(A_x + A_y)} \times I_x$$

Analyzing those formulas, we can notice:

- If the  $A_x$  value is much bigger than  $A_y$  => we have a slab with one span direction => the final inertia per mesh will be very close to  $I_y$  corresponding to  $A_x$ .
- If the reinforcement areas  $A_x$  and  $A_y$  are similar => we have a slab with two span directions => we will get 
$$I = 0.50 \times I_y + 0.50 \times I_x$$

### Error messages

In the property list of linear and planar elements, the user has the possibility to impose a maximum allowable deflection:

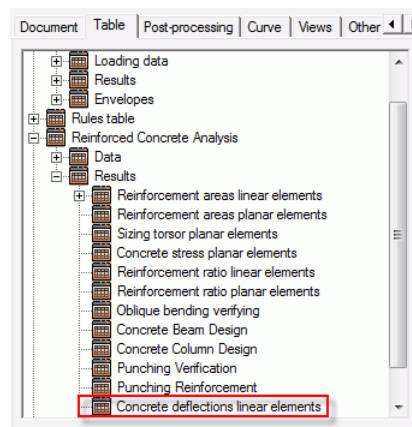


At the end of the calculation, the deflection returned by Advance Design is compared to the limit imposed by user in the property sheet => if the limit is exceeded, the software returns an error message.

The default limit was set to 1/250 to match the requirements from EN1992-1-1.

### Results tables in the report

New tables were also implemented in the "Reinforced Concrete Analysis" section:

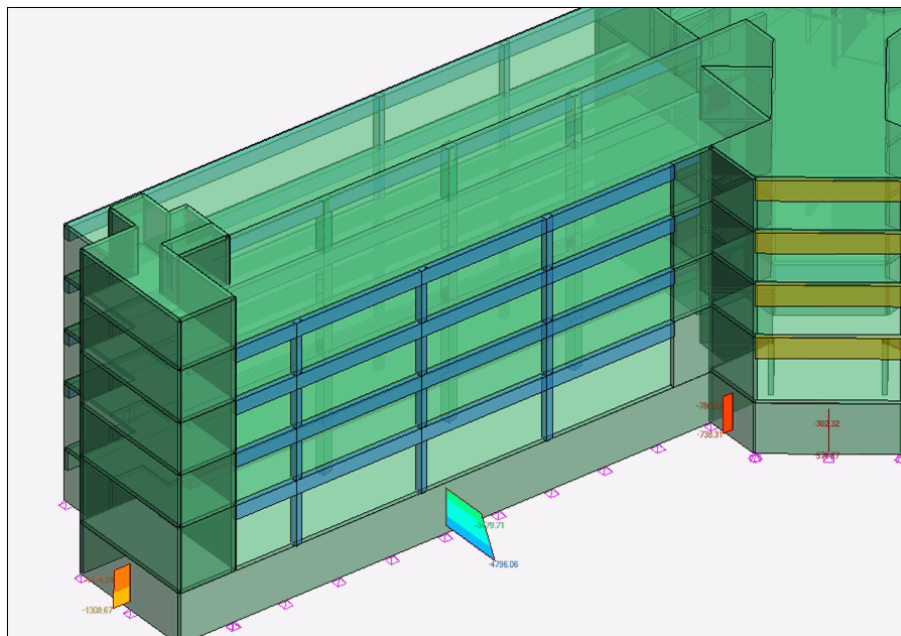


*Table providing deflection results on linear elements*

## Analysis and design

### Implementation of T6-Q9 elements

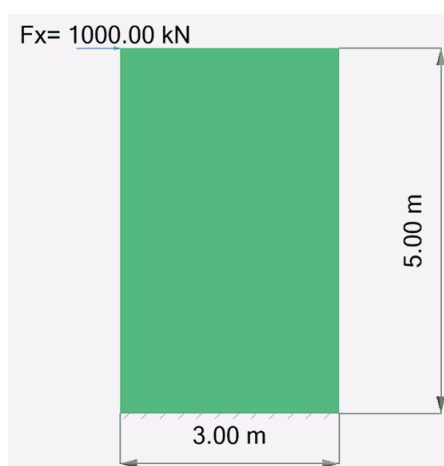
When it comes to wall calculation, torsors can prove to be extremely useful, providing a single value for axial force, shear force and bending moment on top and bottom parts of the wall.



Yet, in previous versions, torsors on planar elements were highly dependent on mesh size.

Even on simplistic models, the difference between the Advance Design result and the reference result could be over 25% when using an inappropriate mesh size.

On the following example, one would expect a 5000 kN.m bending moment on support ( $1000\text{kN} \times 5\text{m}$ ).



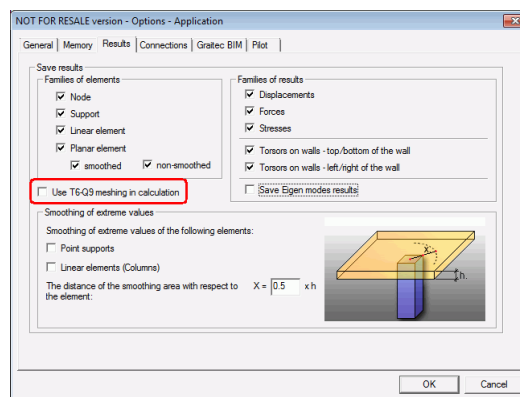


Yet, depending on mesh size, the difference between the reference value and the result given by Advance Design 2014 SP1 could be up to 27%.

Mesh size (m)	Reference value (kN.m)	Advance Design 2014 SP1 (kN.m)	Difference (%)
0.50	4750	4677	1.54
0.75	4625	4505	2.6
1.00	4500	4262	5.29
1.50	4250	3644	14.26
2.00	3750	2751	26.64

**Note:** In Advance Design, the automatic torsors are obtained by creating a section cut in the middle of the first mesh. Therefore, the reference value is different for each mesh size.

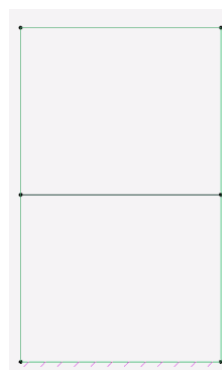
Advance Design 2015 now solves this issue by enabling a new "T6-Q9" meshing option in the solver, introducing a middle node in the T3-Q4 (Triangles and Quadrangles) elements.



Activating this new post-processing option, the gap between the Advance Design result and the reference result becomes insignificant:

Mesh size (m)	Reference value (kN.m)	Advance Design 2015 (kN.m)	Difference (%)
0.50	4750	4752	0.04
0.75	4625	4639	0.30
1.00	4500	4505	0.07
1.50	4250	4213	0.87
2.00	3750	4213	12.50

A 12.50% difference can still be noticed for a 2m mesh size, but please note that such a large size leads to only one mesh for the entire width of the wall.



Mesh size = 2m

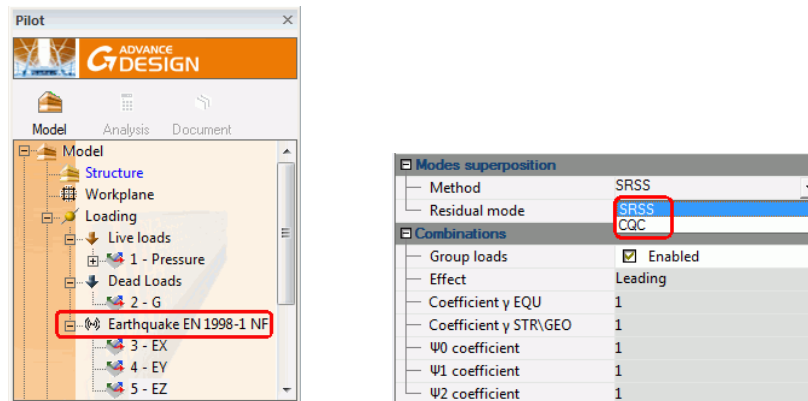
We would highly recommend using a smaller mesh size in this case.

## Update of the SRSS method

In June 2013, when publishing Service Pack 1 for AD2013, we decided to temporarily remove the SRSS summation method.

Advance Design 2015 now brings this method back, and including some major improvements regarding torsors calculation (e.g. torsors per level, per group of walls, torsors on section cuts...) that were until now only available with the CQC method.

Our customers can now use this simplified SRSS method in order to reduce calculation time during seismic analysis.

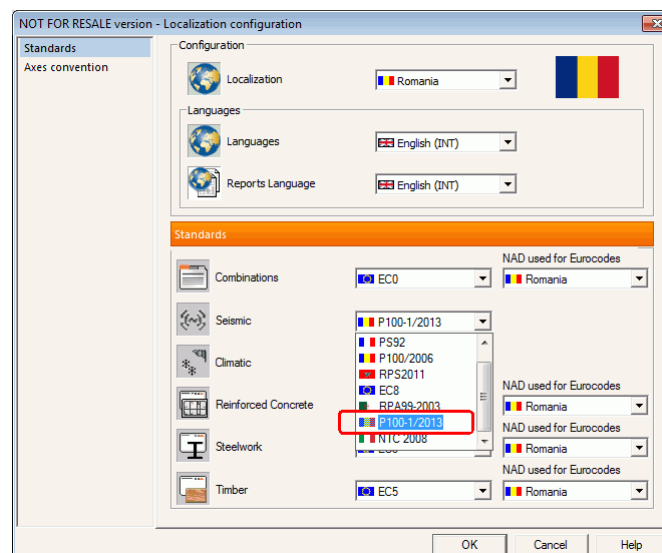


Be careful though for this method is only allowed on regular structures.

## Update of the Romanian seismic codes – P100-1/2013

The 2015 release of Advance Design includes the latest update to the Romanian seismic codes => P100-1/2013.

In addition to the previous P100/2006 (which is still available), the user has a new entry in the configuration dialog:



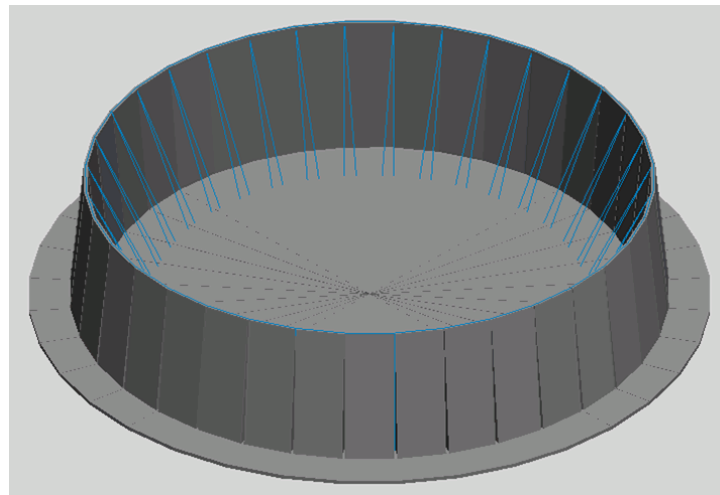
## Concrete design on planar elements with variable thickness

When designing concrete elements with variable thickness, previous versions would only consider thickness related to the 1st creation point ("1st vertex").

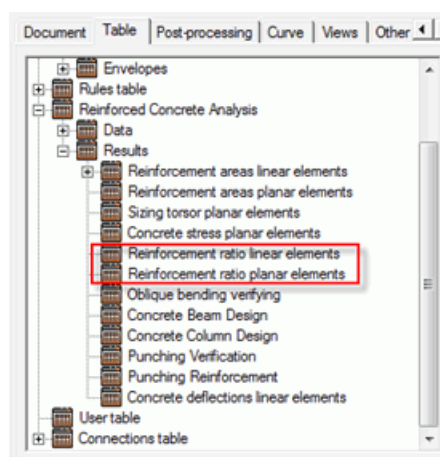
Thickness	
1st vertex	14.00 cm
Slope x	0.05
Slope y	0
Concrete inertia type	Imposed value
Cracked section inertia coe...	1

With slopes being only positive in Advance Design, this led the concrete design engine to consider the thinnest part of the element, resulting in pessimistic results.

Advance Design 2015 is now able to consider an average thickness for each mesh, using it as input for concrete design (Eurocode 2 or BAEL), thus reducing reinforcement areas in a noticeable manner.



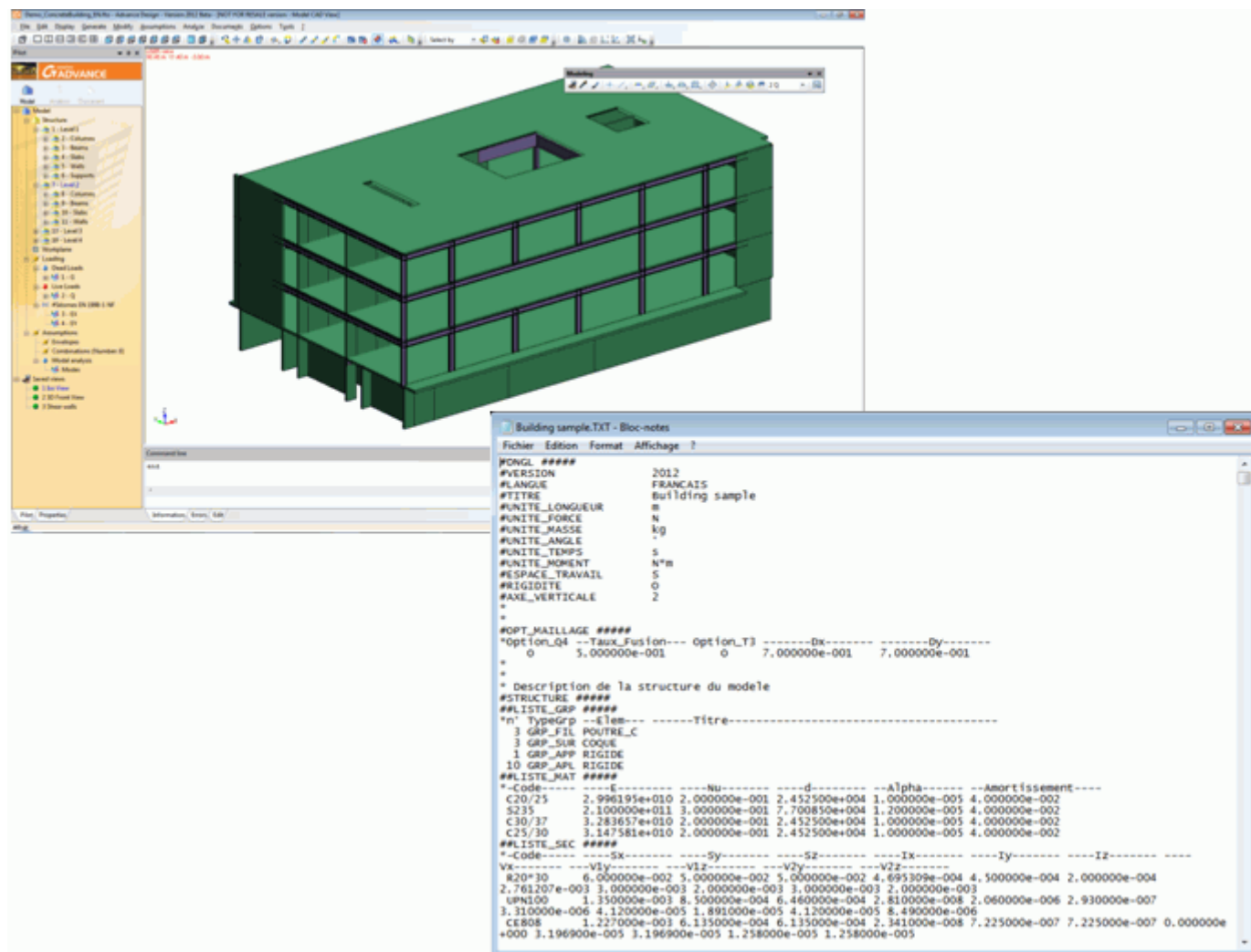
After calculation, the average thickness considered for each mesh is given in the following tables:



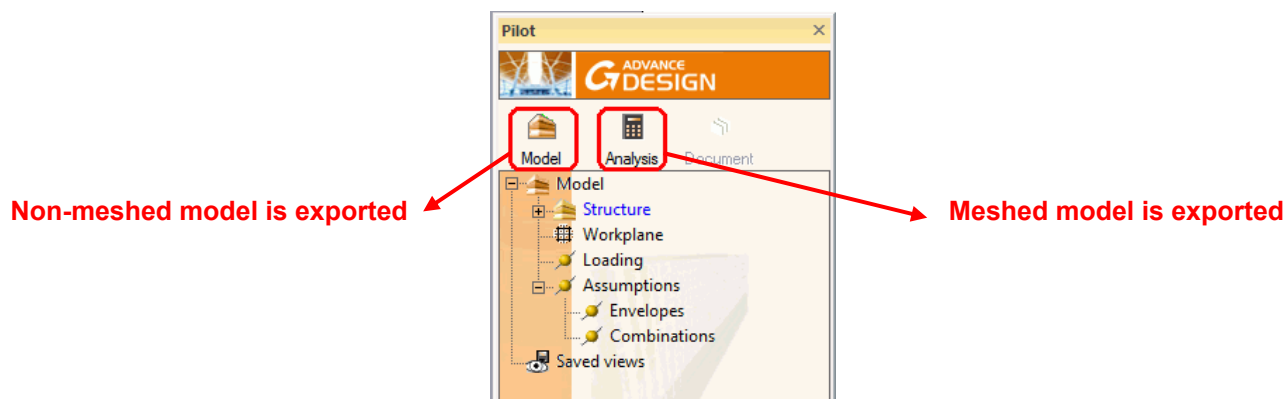
## Improvements on export as .TXT file

Version 2012 made it possible for users to export their Advance Design model into a text file.

The **File > Export > Text file** would create a .TXT file with all parameters.



Depending whether the user is in **Model** or **Analysis** mode, Advance Design would export the non-meshed model or the meshed model.

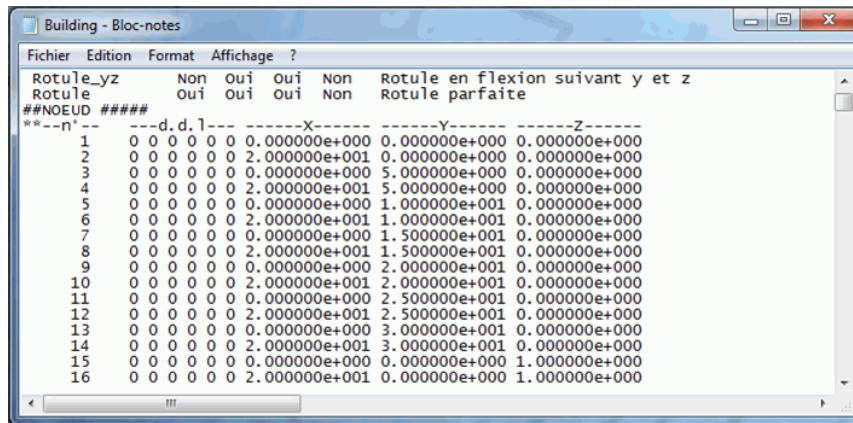


Yet, no matter what user chose, **loads were always exported as non-meshed**.

Advance Design 2015 removes this limitation: loads can be **exported as meshed loads** as soon as the **model has been calculated**.

Version 2015 also makes this .TXT file easier to manage:

- by removing extraneous information (keeping only those related to geometry, material and loads);
- by adding a description of nodes with their corresponding coordinates.

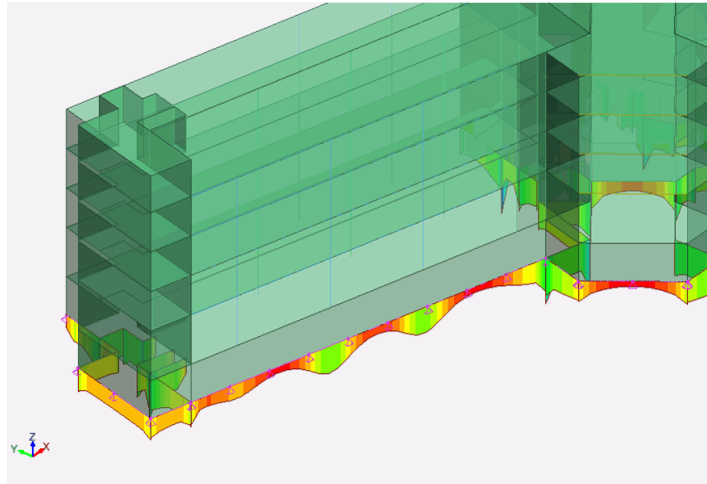


## Post processing

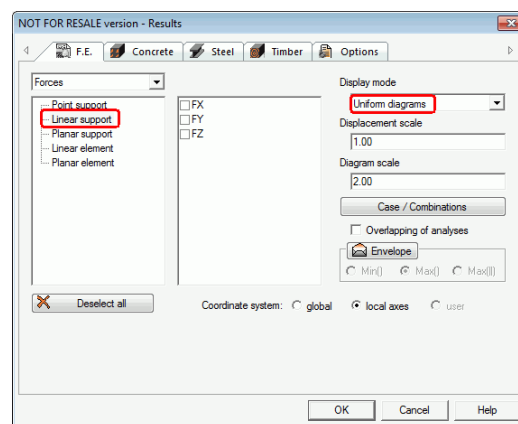
### Uniform diagrams for linear support actions

Advance Design enables the user to display actions on linear supports as diagrams.

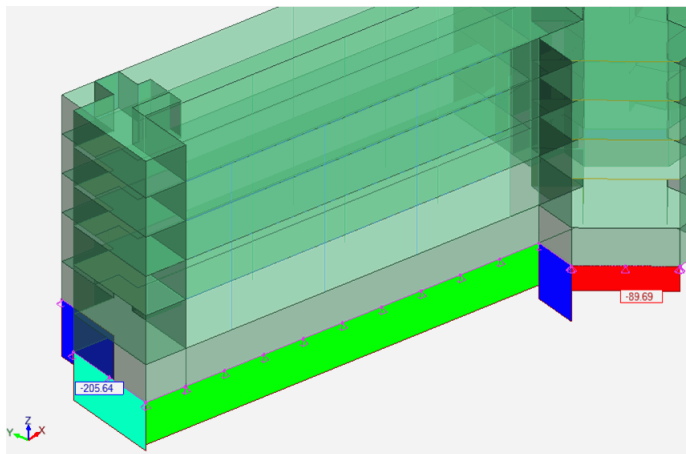
Yet, users looking for single value per support would find these diagrams difficult to post-process.



Therefore, Advance Design 2015 adds a new post-processing option, enabling actions on supports to be displayed as uniform diagrams.



Advance Design 2015 thus provides a single value per support (in kN/m), that can easily be used for footing design.

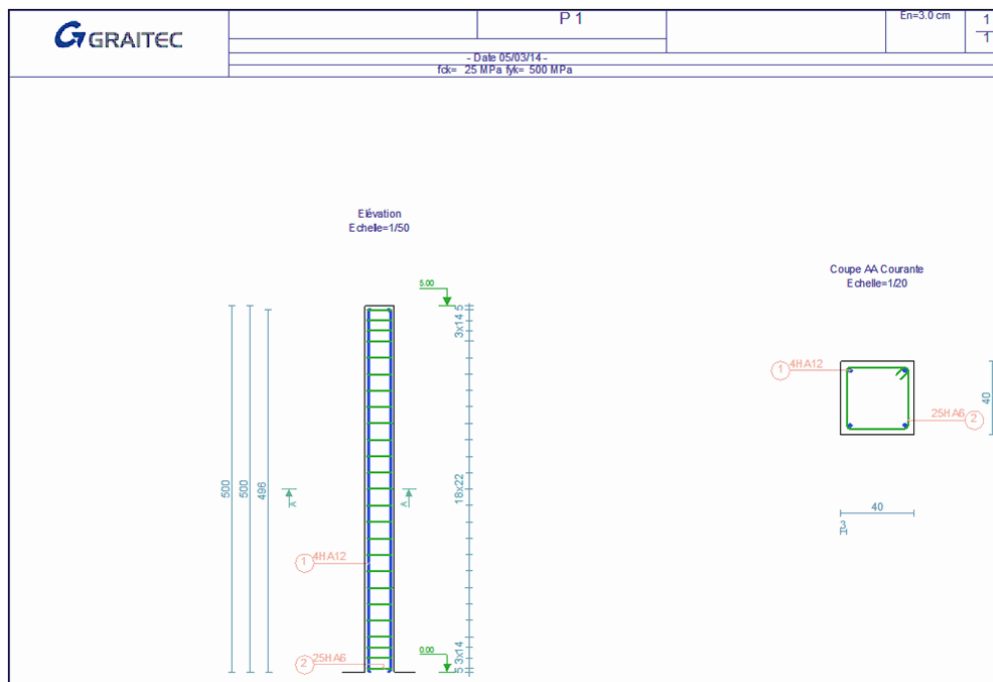
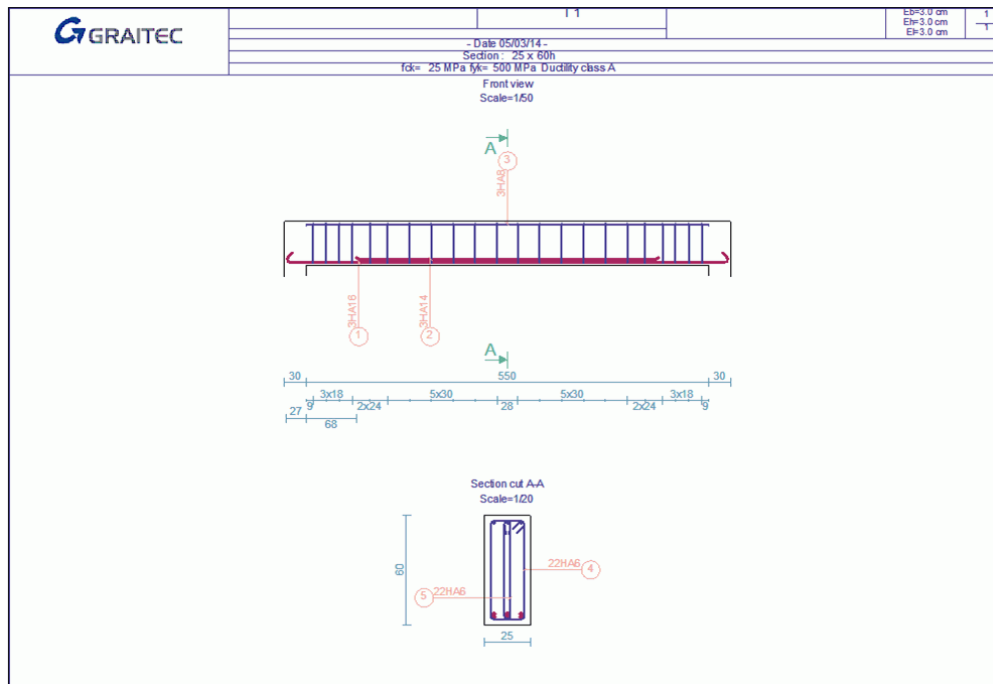




## Reinforcement drawings changes

In recent releases, Advance Design has been able to produce reinforcement drawings for beams and columns. Based on user feedback, we decided to remove some information from those reinforcement drawings to make them easier to read:

- The bar schedule has been removed because it was irrelevant for some countries.
- We have improved the scale management in order to better fit the paper scale.
- We added the number and the diameter of the bars in the bar marks.



## **Miscellaneous improvements & corrections**

Advance Design 2015 comes with more than 120 improvements and corrections.

The list given here after is just an extract of all of them.

### **General application**

- New icons
- Node Ids displayed through the "Annotation on selection" feature were incorrect (#15569).
- Soil manager would always display soil names but soil properties were sometimes not visible (#15515).
- Local axes on linear supports could be displayed but they could not be hidden (#15380).
- Linear elements created from lines would get an incorrect cross-section (#15359).

### **Import / Export**

- Some windwall properties were lost during GTC export (#15607).
- Accidental loads now keep their properties during GTC export (#15354).
- During GTCx import\export, the variable thickness on planar elements was not preserved (#15181)

### **Climatic generator**

- Some wind forces would get an incorrect sign when set on French climatic codes NV2009 (#15574).
- Wind forces would be missing on some models with duopitch roof when set on Eurocode 1 with UK appendix (#15306)

### **Seismical analysis**

- Depending on the number of combinations, the "Sum of actions on supports" table would return empty cells (#15286).

### **Concrete design**

- With the previous release, it was impossible to display the EC2 design forces on planar elements (#15481).
- Correction of a display problem when asking the real reinforcements values on planar elements => the option "Mean values" was not saved when calling back the results (#15495)
- In some cases, having "save reinforcement drawings" option active was inactivating the EC2 concrete design results (no concrete results toolbar and reports). Without this option is unchecked, then the results were available (#15570).

### **Steel design**

- Intermediate restraints for lateral torsional buckling were not always properly reset to their initial properties (#15183).

### **Reports**

- Post-processing views inserted in the calculation report would slightly differ from the ones saved by user (incorrect cutting or clipping (#15215).

### **Post-processing**

- Actions on supports displayed as vectors would be given with incorrect orientation (#15552).
- Envelope stresses on planar elements were shown as isoregions instead of diagrams (#15273).
- Mesh nodes were appearing for a second when creating any post-processing result from the Results settings window (#15575).