Release Note

Release Date : Mar. 2017

Product Ver. : nGen 2017 (v2.1)

Next Generate Software
for Integrated Analysis, Design, Drawing of Building Systems

Contents

1. Imperfection Loads as per EN1992-1-1 & EN1993-1-1

Equivalent Horizontal Loads

Global initial sway imperfection is determined as coefficient, Φ, which is multiplied by vertical loads of structure.

Equivalent horizontal load, $HL = V_{Ed} \cdot \phi$

$$\phi = \phi_0 \cdot \alpha_h \cdot \alpha_m$$

Where, ϕ_0 is the basic value, $\phi_0 = 1/200$

α_h is the reduction factor for height h, applicable to columns:

$$\alpha_h = \frac{2}{\sqrt{h}}, \quad \text{but} \quad 2/3 \le \alpha_h \le 1.0$$

h is the height of the structure in meters

α_m is the reduction factor for the number of column in a row:

$$\alpha_m = \sqrt{0{,}5 \cdot \left(1 + \frac{1}{m}\right)}$$

m is the number of columns in a row. m=3 in the figure below.

Clause 5.3.2(4)B in EN1993-1-1 states that where the overall applied lateral loads are more than 15% of the vertical loads in a member then the notional horizontal loads can be ignored. This is expressed as HEd ≥ 0.15 VEd.
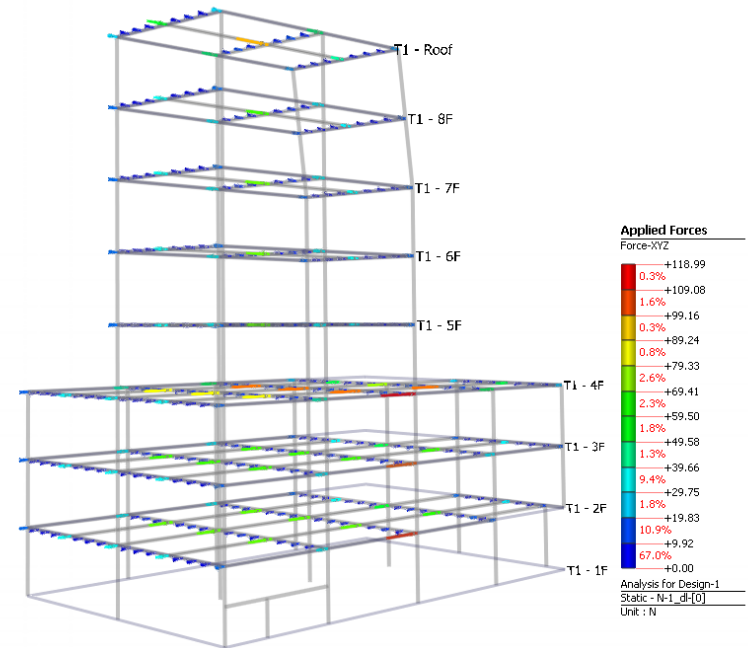

Example of Equivalent Horizontal Load

1. Imperfection Loads as per EN1992-1-1 & EN1993-1-1

Calculate the coefficient, Φ

- **Load > Lateral > Imperfection > Define Initial Sway Coefficient**

It provides both automatic calculation of coefficient considering story height and No. of columns and user defining feature of user coefficient.

Columns on a same line for the inputted angle is counted automatically, and the maximum number of columns is indicated in the Imperfection data table.

No.=2
No.=3
No.=3
No.=4
No.=5
No.=1
No.=1
No.=3
No.=5
No.=3

Auto-Define of Column No.
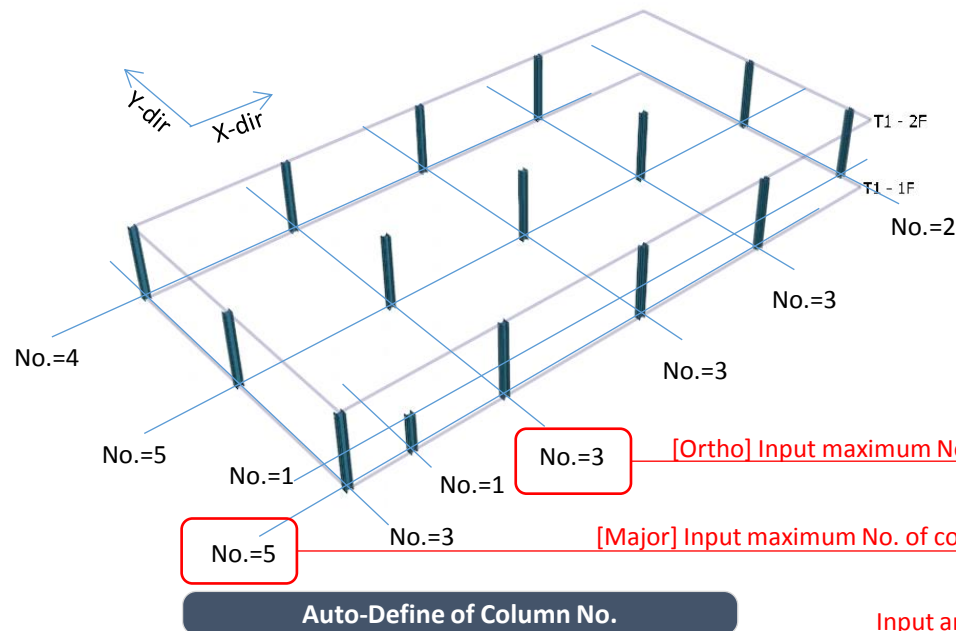
Define Initial Sway Coefficient

Name: Initial Sway Coefficient-1

Design Imperfection
- ○ Code Based EN-1993-1-1-2005 ▾   ○ User Defined

Parameter
Reduction factor of parameter
- ○ height of the structure
  - ☑ Program determined   32 m
  - ○ height of the story

angle of the initial sway,   1 /   200

Imperfection Data

Set	Story	Height (m)	No. of Column Major	No. of Column Ortho.	Coefficient Major	Coefficient Ortho.
T1	Roof	4.00	3	2	0.0014	0.0015
T1	8F	4.00	3	2	0.0014	0.0015
T1	7F	4.00	3	2	0.0014	0.0015
T1	6F	4.00	3	2	0.0014	0.0015
T1	5F	4.00	3	2	0.0014	0.0015
T1	4F	4.00	5	3	0.0014	0.0014
T1	3F	4.00	5	3	0.0014	0.0014
T1	2F	4.00	5	3	0.0014	0.0014
T1	1F	0.00	0	0	0.0000	0.0000

Update number of column according direction   0 deg

[Ortho] Input maximum No. of columns
[Major] Input maximum No. of columns
Input angle of axis

1. Imperfection Loads as per EN1992-1-1 & EN1993-1-1

Calculate Imperfection Load

- *Load > > Lateral > Imperfection > Assign Imperfection*

 Create Load Case and Nodal Load for Imperfection automatically.

- Equivalent load of Local Imperfection is not supported and Nodal Load should be defined by user for wall

- Imperfection load is defined for the sum of axial force of story and analysis is performed based on distribution according to the mass ratios of each nodes.

Assign Imperfection loads

Applied Force by Imperfection
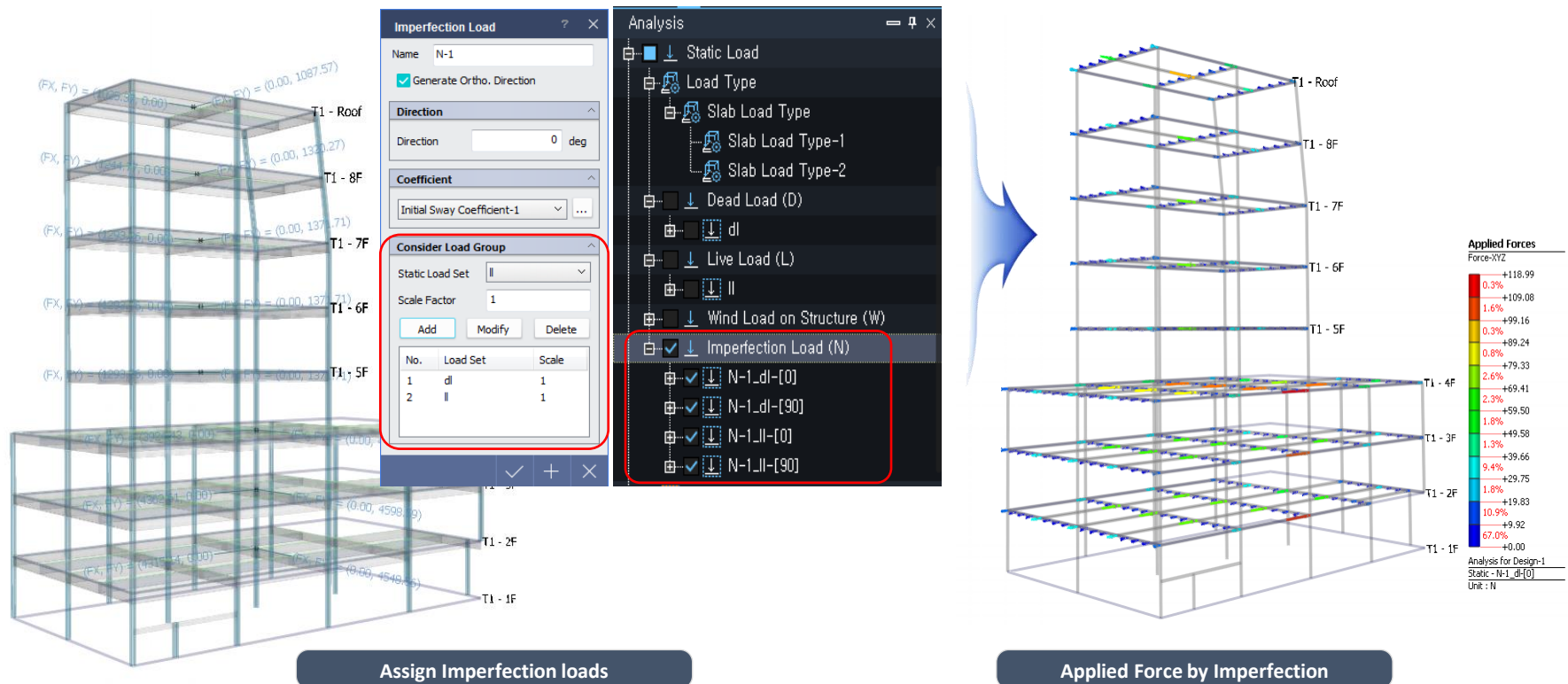
1. Imperfection Loads as per EN1992-1-1 & EN1993-1-1

Generation of Imperfection Load

- Imperfection load generation and the verification results are shown below.

- The compared result of 15% of axial force and lateral force is not provided in the current version but it will be implemented in the next version.

Imperfection Load Generation Method

Imperfection Load Generation in midas Gen
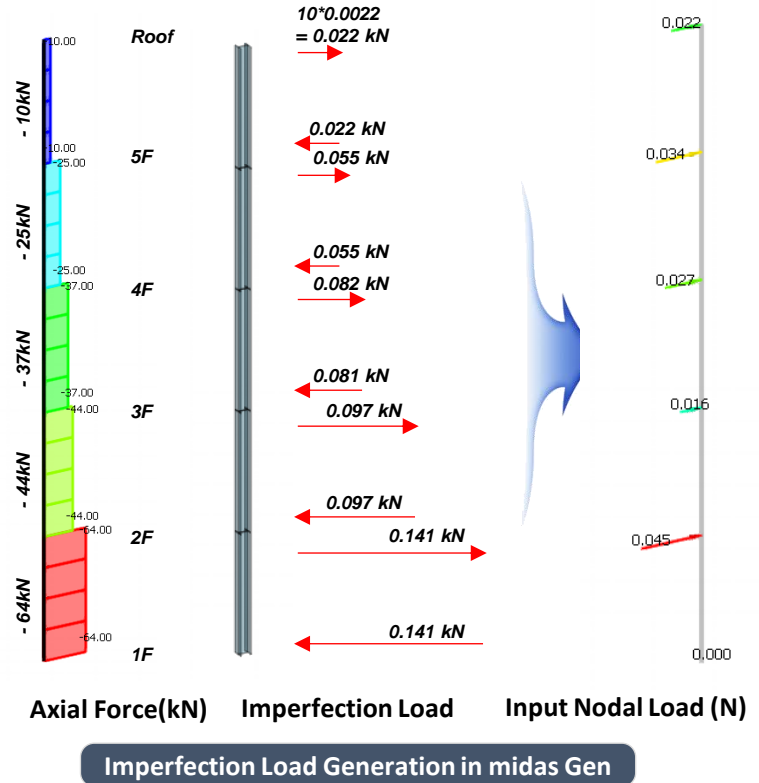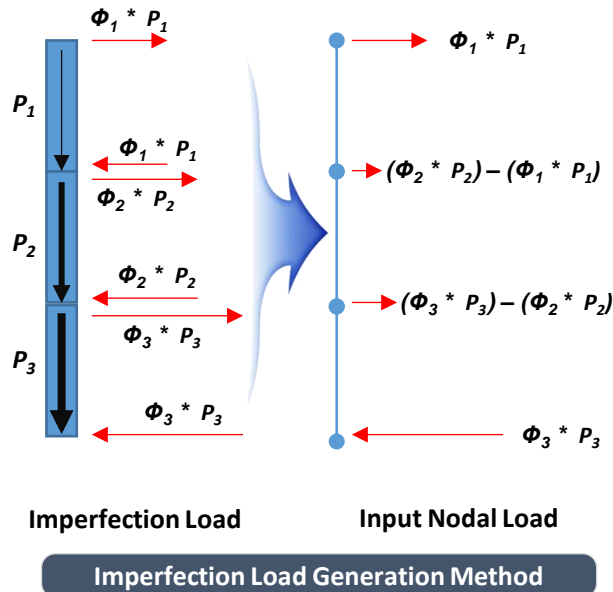
	Set	Story	Height (m)	No. of Column		Coefficient	
				Major	Ortho.	Major	Ortho.
	T1	Roof	4.00	1	1	0.0022	0.0022
	T1	5F	4.00	1	1	0.0022	0.0022
	T1	4F	4.00	1	1	0.0022	0.0022
	T1	3F	4.00	1	1	0.0022	0.0022
	T1	2F	4.00	1	1	0.0022	0.0022
	T1	1F	0.00	0	0	0.0000	0.0000

1. Imperfection Loads as per EN1992-1-1 & EN1993-1-1

Create Load Combination

- *Design > Load Combination > Load Combination*

Dead Load and Live Load are applied to all Imperfection Load Case in Load Combination. For the Load Combination which contains lateral load, imperfection load case in the same direction as lateral load will only be considered. Below is the example of Imperfection Load Case for Dead Load, Live Load, Wind Load and Seismic Load for Load Combination.

EN1993-1-1-2005

Fundamental | Accidental | Seismic | Characteristic | Frequent | Quasi-permanent | Fatigue

Act.	Name	Sum	NL.	Description	D	N	N	N	N	L	W	W	W	W
					dl	N-1_dl-[0]	N-1_dl-[90]	N-1_ll-[0]	N-1_ll-[90]	ll	Wind Load-1-[0]	Wind Load-1-[90]	Wind Load-1-[180]	Wind Load-1-[270]
✓	fdLCB1_1	ADD	☐	1.35D+1.00NX	1.35	1.35								
✓	fdLCB1_2	ADD	☐	1.35D-1.00NX	1.35	-1.35								
✓	fdLCB2_1	ADD	☐	1.35D+1.00NY	1.35		1.35							
✓	fdLCB2_2	ADD	☐	1.35D-1.00NY	1.35		-1.35							
✓	fdLCB3	ADD	☐	1.35D	1.35									
✓	fdLCB4_1	ADD	☐	1.35D+1.50(1.00ll)+1.00NX	1.35	1.35		1.50		1.50				
✓	fdLCB4_4	ADD	☐	1.35D+1.50(1.00ll)-1.00NX	1.35	-1.35		-1.50		1.50				
✓	fdLCB5_1	ADD	☐	1.35D+1.50(1.00ll)+1.00NY	1.35		1.35		1.50	1.50				
✓	fdLCB5_4	ADD	☐	1.35D+1.50(1.00ll)-1.00NY	1.35		-1.35		-1.50	1.50				
✓	fdLCB6	ADD	☐	1.35D+1.50(1.00ll)	1.35					1.50				
✓	fdLCB10_1	ADD	☐	1.35D+1.50(1.00ll)+0.90WX+1.00NX	1.35	1.35		1.50		1.50	0.90			
✓	fdLCB10_1_1	ADD	☐	1.35D+1.50(0.70ll)+1.50WX+1.00NX	1.35	1.35		1.50		1.05	1.50			
✓	fdLCB10_4	ADD	☐	1.35D+1.50(1.00ll)+0.90WX-1.00NX	1.35	-1.35		-1.50		1.50	0.90			
✓	fdLCB10_4_4	ADD	☐	1.35D+1.50(0.70ll)+1.50WX-1.00NX	1.35	-1.35		-1.50		1.05	1.50			
✓	fdLCB10_5	ADD	☐	1.35D+1.50(1.00ll)-0.90WX+1.00NX	1.35	1.35		1.50		1.50	-0.90			
✓	fdLCB10_5_5	ADD	☐	1.35D+1.50(0.70ll)-1.50WX+1.00NX	1.35	1.35		1.50		1.05	-1.50			
✓	fdLCB10_8	ADD	☐	1.35D+1.50(1.00ll)-0.90WX-1.00NX	1.35	-1.35		-1.50		1.50	-0.90			
✓	fdLCB10_8_8	ADD	☐	1.35D+1.50(0.70ll)-1.50WX-1.00NX	1.35	-1.35		-1.50		1.05	-1.50			

Load Combination for Imperfection Loads

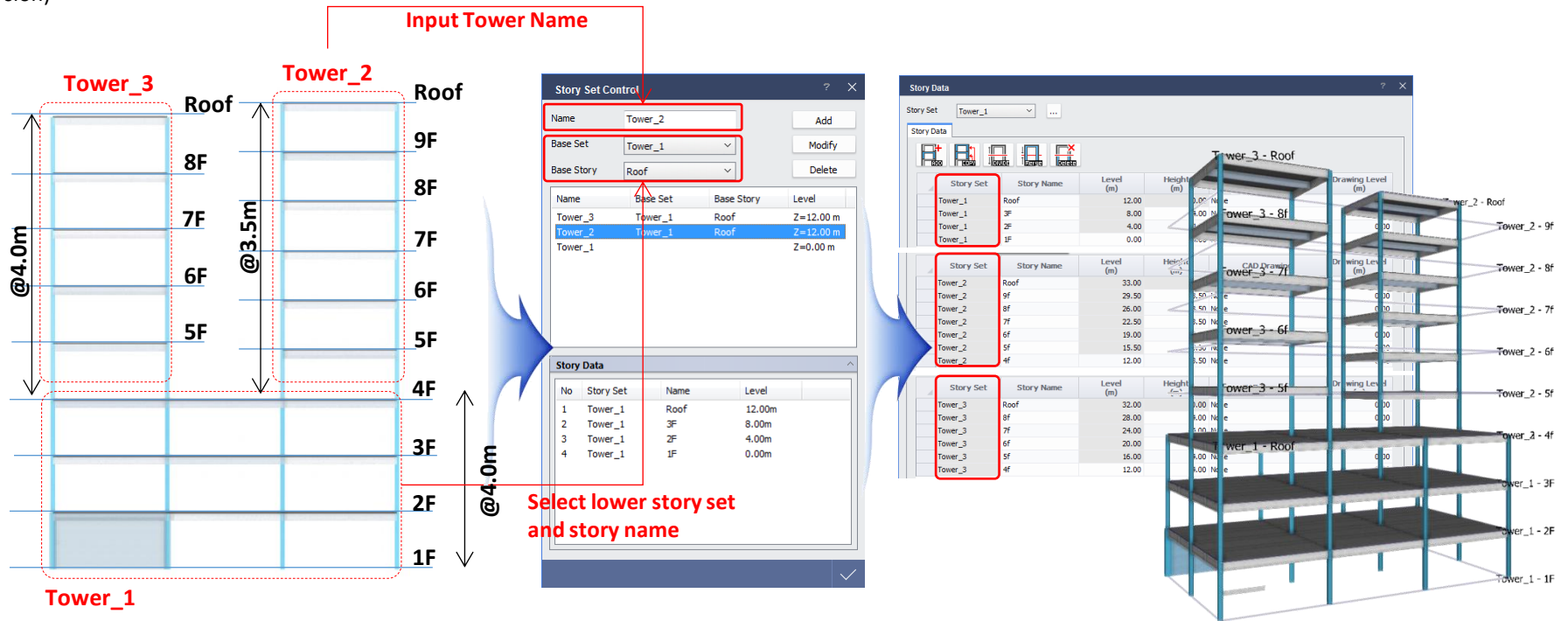# 2. Modeling and Analysis for Multi Tower

Create Story Set and Input Story Data

- **Structure > Story > Story > Story Data**

Story Data defining feature has been improved in order to define individual towers and corresponding story information for analysis or load input for Multi Tower.

Story Set of each tower can be defined in Story Set Control and then story information can be defined for each Story Set.

In case of Multi Tower, story information can only be inputted manually and Auto Generate Story Data function is not provided. (This is planned to be applied in the next version)
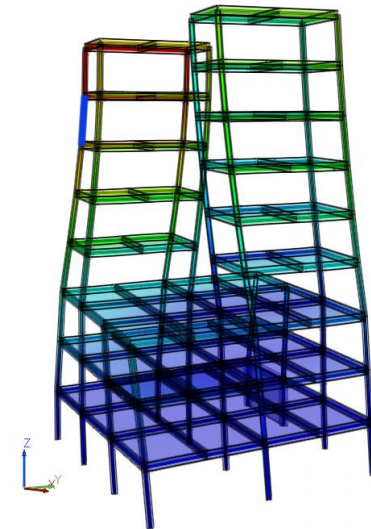

Define Story Set

Define Story Data for Each Story Set

2. Modeling and Analysis for Multi Tower

Define Story Diaphragm and Input Lateral Load

- Diaphragm is defined by selecting members in nGen so that plane of Story Set with same level can be defined freely.

- Seismic load and wind load are automatically generated according to Story Data or model information for each Story Set.

Define Story Diaphragm

Auto generation of Wind & Seismic Load

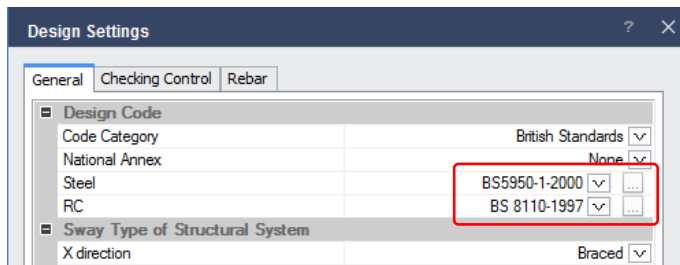

Analysis Result for Multi Tower
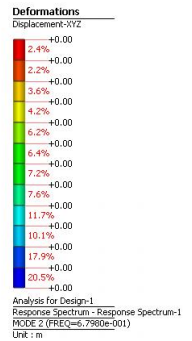
3. Member Design by BS code
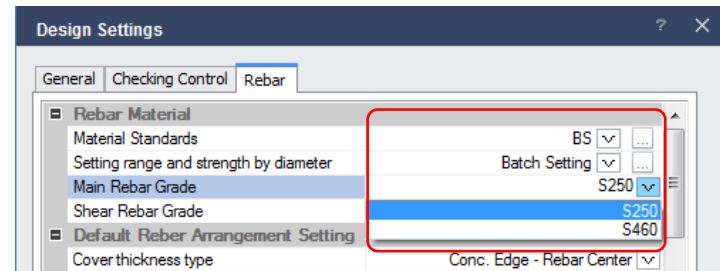
Add Design Code and Material DB for BS

- *Design > Design Settings > General and Rebar tab*

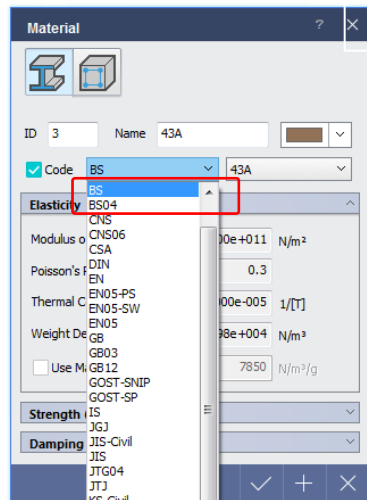For the Steel Design, BS5950-1-2000 is added, and For RC Design, BS 8110-1997 is added.

BS DB has been added for RC and Steel materials and Rebar.

Setting of Design Code

Setting of Rebar Material

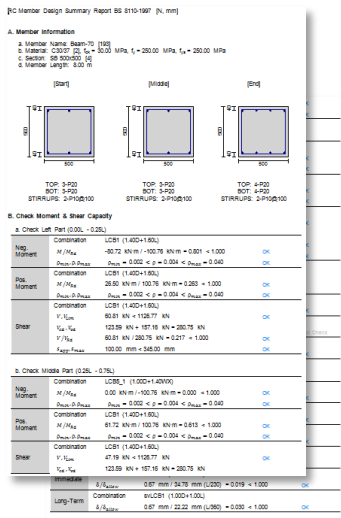
Setting of Steel and RC Material

3. Member Design by BS code

Added Design Code

- *Design > Design Settings > General and Rebar tab*

Summary and Detail Report are provided for each member types.

RC Beam (Summary)

RC Column (Summary)
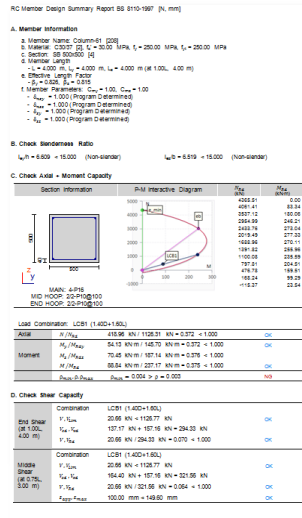
RC Wall (Summary)
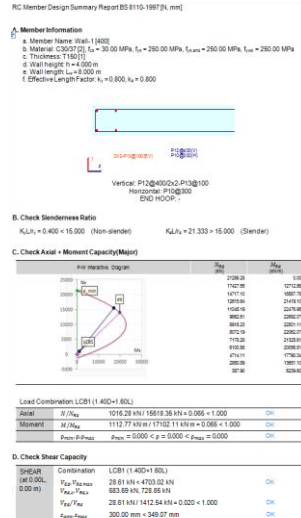
RC Slab (Summary)
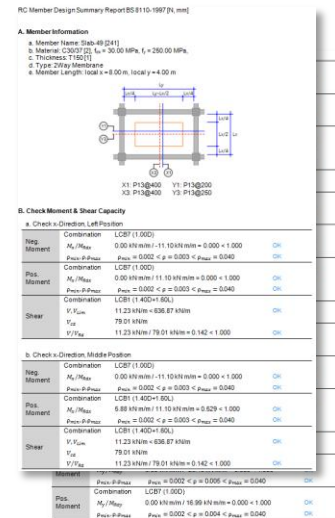
Steel (Summary)
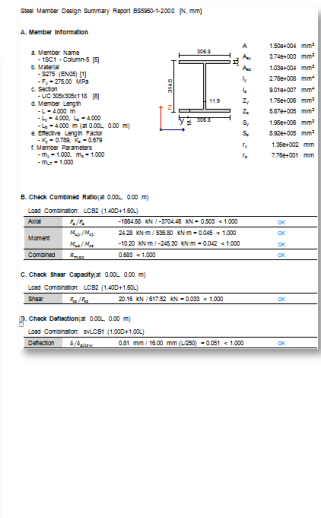
	RC Beam / Slab	RC Column / Wall	Steel
Check Items	Moment Capacity	Slenderness	Classification of Cross-Section
	Shear Capacity	Axial + Moment Capacity	Axial + Shear + Moment Capacity
	Crack Width (Only Beam)	Shear Capacity	Combined Capacity
	Deflection (Only Beam)	-	Check Deflection
Design Report	Summary	Summary	Summary
	Detail	Detail	Detail

4. Improvement on Floor Load Type Dialog

Add List Box for Floor Load Type and Checking Button for Sub Beam Weight

- **Load > Gravity > Floor Load > Floor Load Type**

Box for Floor Load List has been added for the convenience of addition and modification of Floor Load created by user.

Sub Beam Load are provided in Floor Load and user can now select Load Set to be applied.

nGen 2017 v1.1

nGen 2017 V2.1

5. Enhancement on Checking Analysis Results

Add Display Option by Member

Results can now be reviewed with 'By Member' in order to solve the problem of overlapping text and value when divided Elements are small when 'By Element' is selected.

When 'By Member' is selected result values for entire Member length are displayed at both ends of member and 'Middle value' is provided as an option.
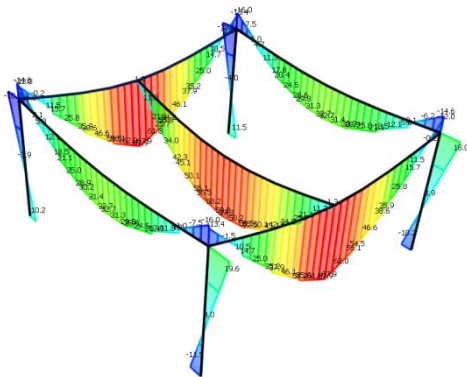
Display by Element (nGen 2017 v1.1)
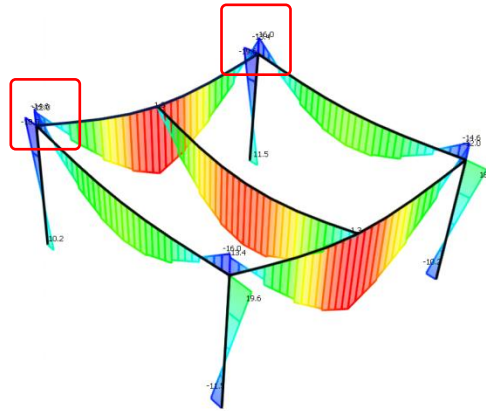
Display by Member
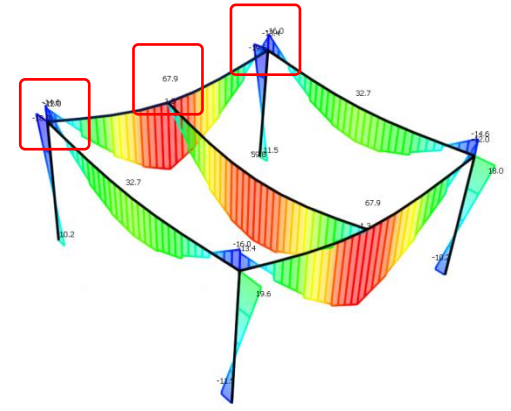
Display by Member + Middle Value

5. Enhancement on Checking Analysis Results

Add Legend detail setting

Double click Legend to activate 'Legend detail setting' dialog and following features are provided:

1. Number of Bands

2. Define option or range of value display

3. Change color type

4. Select members or view label of desired band
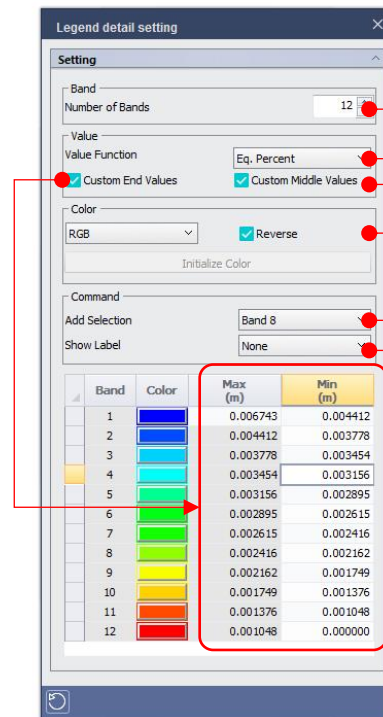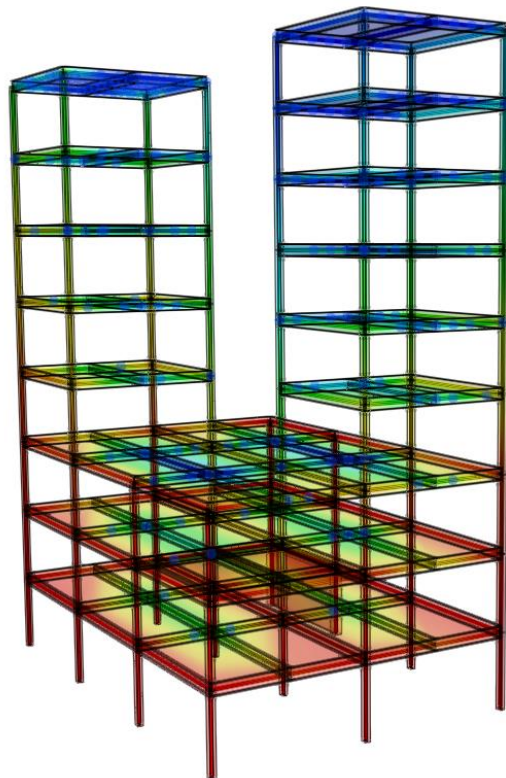
Select Band No.

Select How to Distribute Values

Eq. Interval
Eq. Percent

When checking on, User -input is possible for a range of value

Select Color type

RGB
RGB
Gray
Repeat Two Colors

Select Elements of selected band

Show Elements of selected band

5. Other Enhancement List

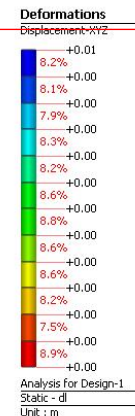| Category	Feature	Detail Description
UI/UX	Model Tree improvement	- Model Tree Material, Section, Thickness, Solid, other properties assigned members color modification - - ID Display
	Tool Bar improvement	- Addition of Sub Point, Tracing on/off, Perspective View, View option
	Properties	- Addition of global settings of Member Set, Story Set, User define color
	Section material expression	- Addition of section material texture in display
	Rotation view improvement	- Improvement in rotation when view is moved with mouse
	Change in Story Data Naming Rule	- Based on GL, upper part will be 1, 2, 3 and so on and lower part will be B1, B2 and so on
Modeling	Mesh improvement	- Contact error improvement occurring in special case
	Addition of undo feature during the action	- Addition of GLUI Undo during drawing of Wall, Slab and Plate
	Multi Tower addition	- Addition of load input and distribution rule for the divaricating part of Base
	Story Mode addition	- Addition of Type : U, N, H, ─ Type in Story Mode
Member	KS16 steel material addition	- SHN 400, HSA800, SCW410,SCW480
Load	Floor Load Type improvement	- Addition of check box for the selected Load set to be included in Sub Beam Weight - Addition of Load Type List selection and modification UI
	Slab Load Type improvement	- Load Type List selection and modification UI addition
	Earth Pressure load input improvement	- Hydraulic pressure and earth pressure can be considered simultaneously
	1Way closed area wind load improvement	- For the load which is only applied to rectangle or square, is modified so that load function can be applied as polygon
	KBC 2016	- Addition of Code Based Wind load and Seismic load
	Function List addition	- Previously defined function can be modified or new function can be defined when function generation is selected. - Wind load, seismic load, RS, Coefficient, Earth Pressure
	Floor Load Error Massage improvement	- Addition of Load and Load Domain Error display

5. Other Enhancement List

Category	Feature	Detail Description
Boundary	Load to mass enhancement	- Addition and enhancement on Slab Load, Arbitrary Load, Loading Table and pre processing mass definition
	Area Spring	- Improvement on result checking in post processing
Analysis	RS Analysis	- Select Mode shape addition
	Reaction Table	- Numerical summation table addition
	Eigenvalue Table	- Cell unit system addition
Result	Contour option	- When Draw Line is selected, banded range is indicated as line - When Gradient Fill is selected, color gradation option between Band is provided - When Cent. Value Leveling is selected, contour or line of center value is outputted for the corresponding element
	Design Result Demand/Capacity	- Based on Capacity, it is scaled so that user can check the problem intuitively. - Sign reversal part is modified - Plate Beam 1D Flexure Member result can be outputted
Design	KSSC Design Code addition	- KSSC LSD16
	Euro RC Design modification	- Characteristic load combination can only be checked when Concrete Stress is checked - Concrete report Naming rule modification
	Select Design Case	- Desired Design Case can be selected to perform design
Output	Report	- English OS Poland string output modification (Global Settings > Languages > Documentation Language selection option addition)
	Story, Plane Mode addition in post processing	- Addition of Story, Plane graphic post processing results output option
ETC	License option correction	- Correction of crashing bug when the model is opened which has no code previously defined.
	Floor Load table improvement	- Table display bug correction (Correction of different part from Model sub point)
	Slab Load Table addition	- Slab Load Type, Load Table addition
	Story, Plane Mode development in post processing	- Addition of Story and Plane result display in post processing mode