

Corso di Laurea in Ingegneria Edile-Architettura

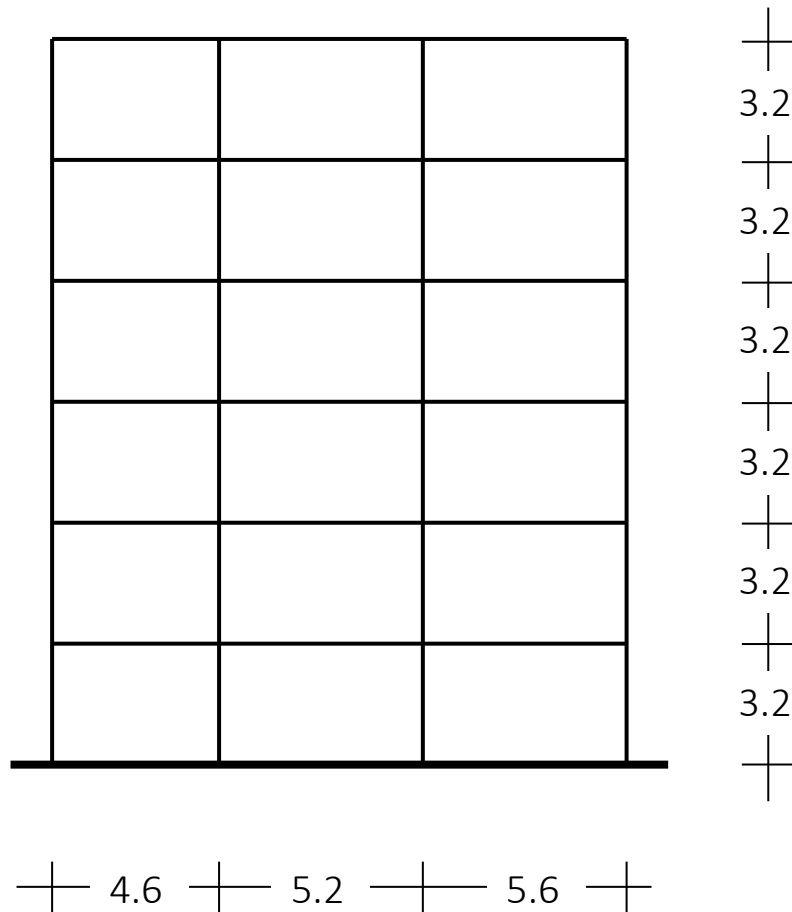
Progetto di costruzioni in zona sismica
A.A. 2024/2025

19 – IL SAP2000: IL TELAIO PIANO

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Telaio piano da modellare

Schema geometrico e materiale



Calcestruzzo: C25/30

$E_c = 31475 \text{ Mpa}$

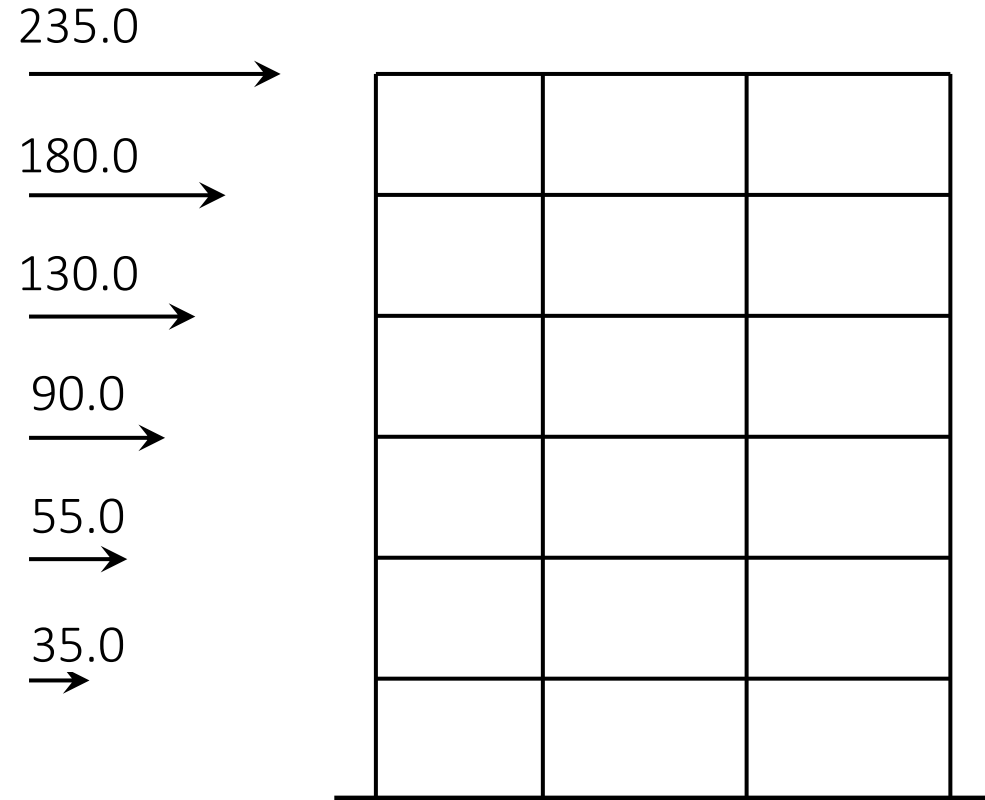
$\nu = 0.1$

Pil. 1	Pil. 2	Pil. 3	Pil. 4
30x30	30x30	30x30	30x30
30x30	30x30	30x30	30x30
30x30	40x30	30x40	30x30
30x30	50x30	30x50	30x30
30x30	60x30	30x60	30x40
30x30	70x30	30x70	30x50

Travi: 30x50 a tutti i piani

Telaio piano da modellare

Carichi



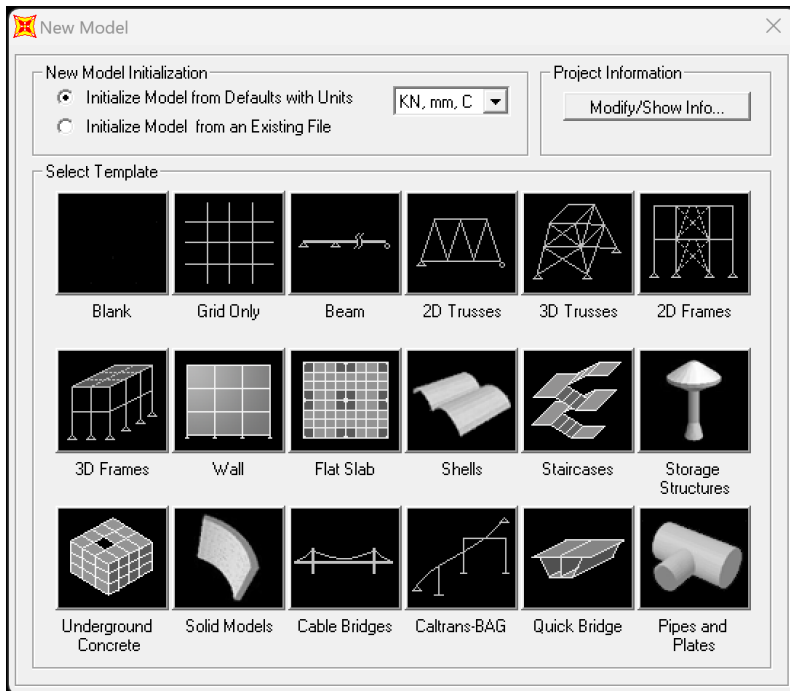
Carichi verticali:

$G_d + Q_d$: 65.0 kN/m 65.0 kN/m 15.0 kN/m

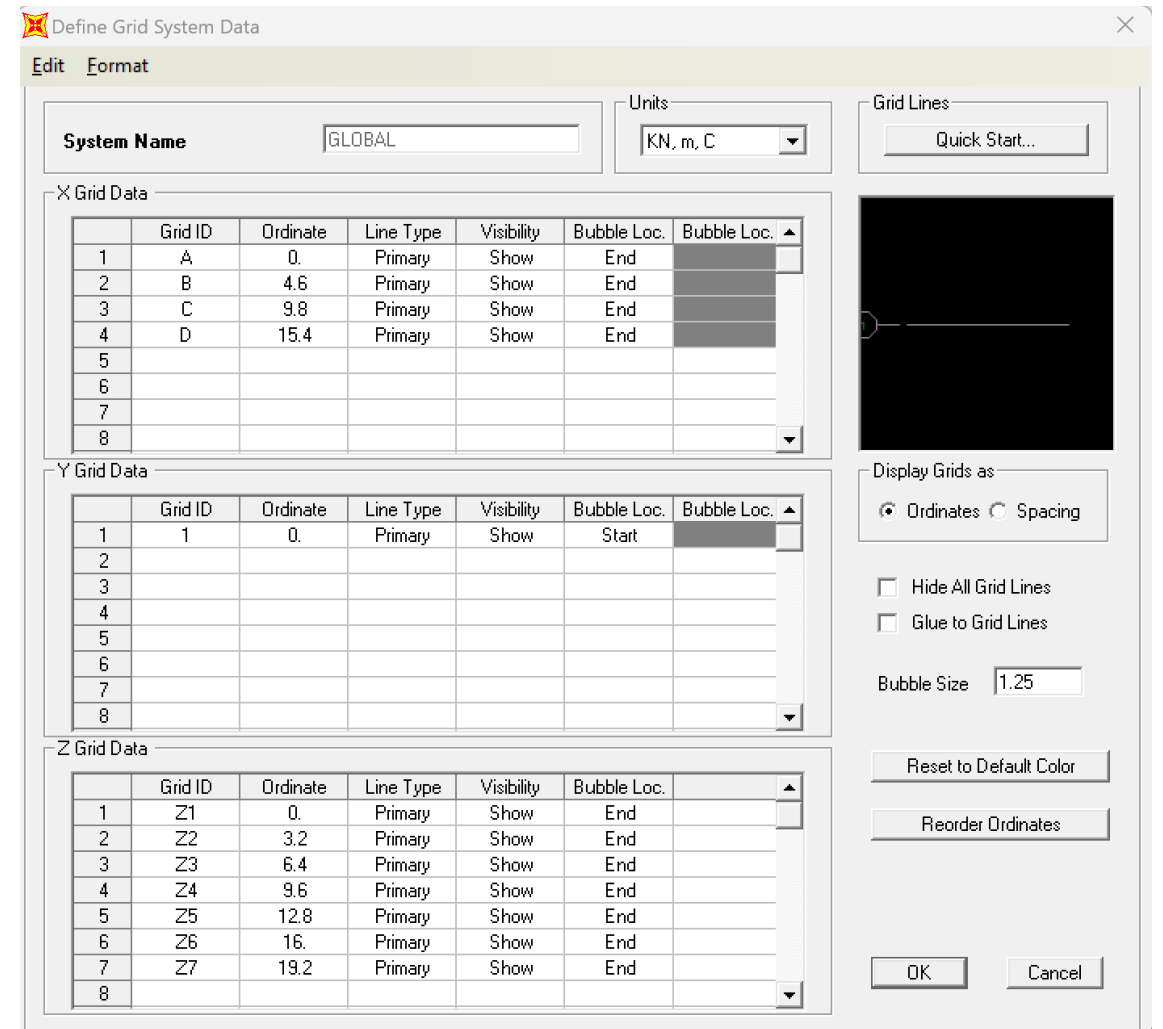
P_d : 26.0 kN 13.0 kN 13.0 kN 39.0 kN

$G_k + \psi_2 Q_k$: 33.0 kN/m 33.0 kN/m 8.0 kN/m

P_k : 20.0 kN 10.0 kN 10.0 kN 30.0 kN



1. Definire la griglia e le unità di misura



2. Modificare le dimensioni della griglia rendendole coerente con luci e altezze d'interpiano del telaio

Define Materials

Materials

A615Gr60
C25/30

Click to:

Add New Material Quick...

Add New Material...

Add Copy of Material...

Modify/Show Material...

Delete Material

☐ Show Advanced Properties

OK

Cancel

3. Definire i materiali

Material Property Data

General Data

Material Name and Display Color C25/30

Material Type Concrete

Material Notes Modify/Show Notes...

Weight and Mass

Weight per Unit Volume 0.

Mass per Unit Volume 0.

Units KN, m, C

Isotropic Property Data

Modulus of Elasticity, E 31475000

Poisson's Ratio, U 0.1

Coefficient of Thermal Expansion, A 1.170E-05

Shear Modulus, G 14306818

Other Properties for Concrete Materials

Specified Concrete Compressive Strength, f'c 14200.

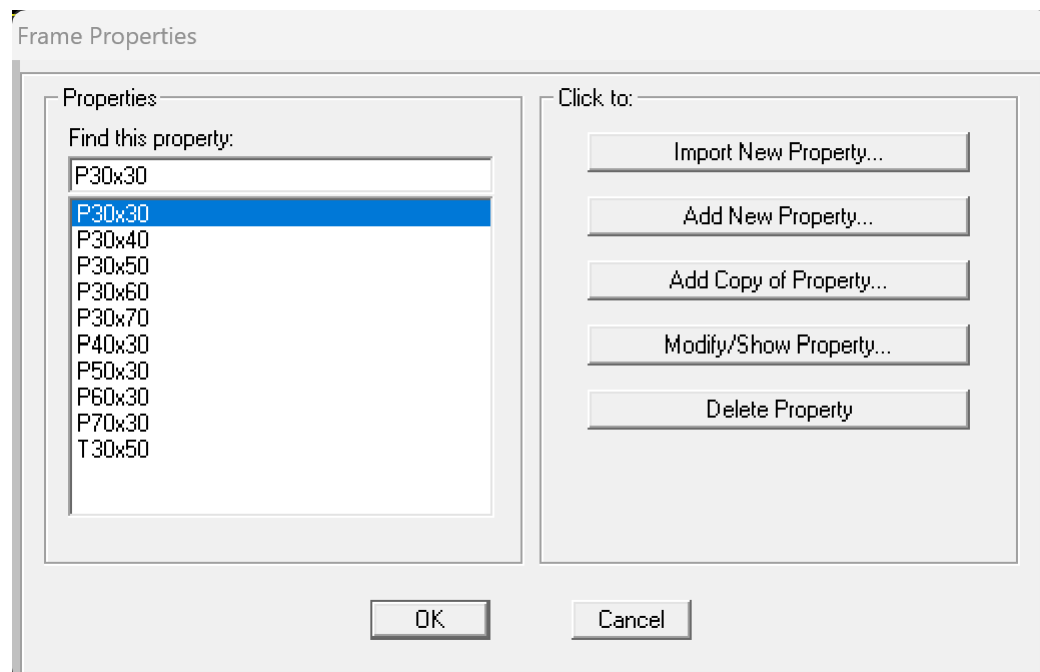
☐ Lightweight Concrete

Shear Strength Reduction Factor

☐ Switch To Advanced Property Display

OK

Cancel



4. Definire le sezioni

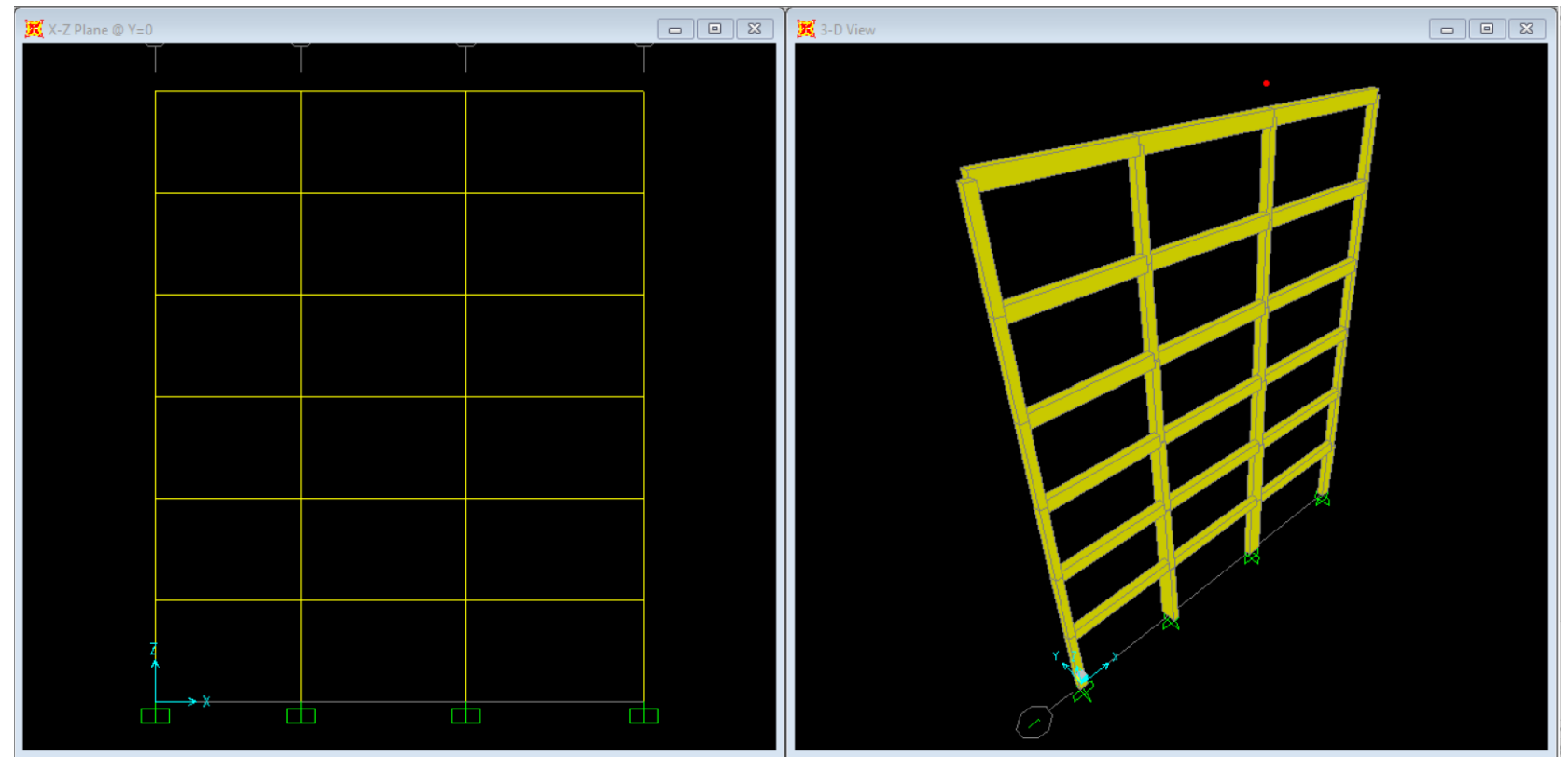
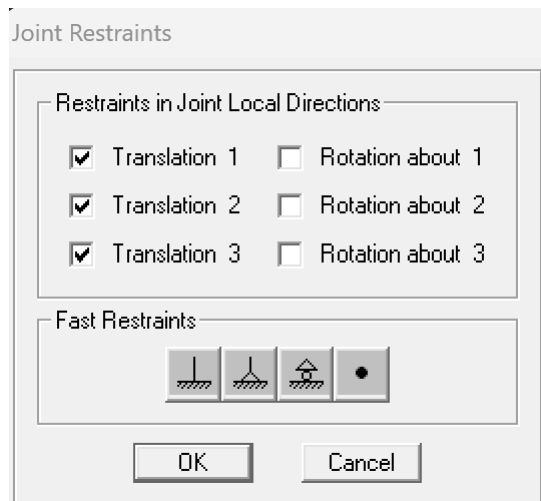


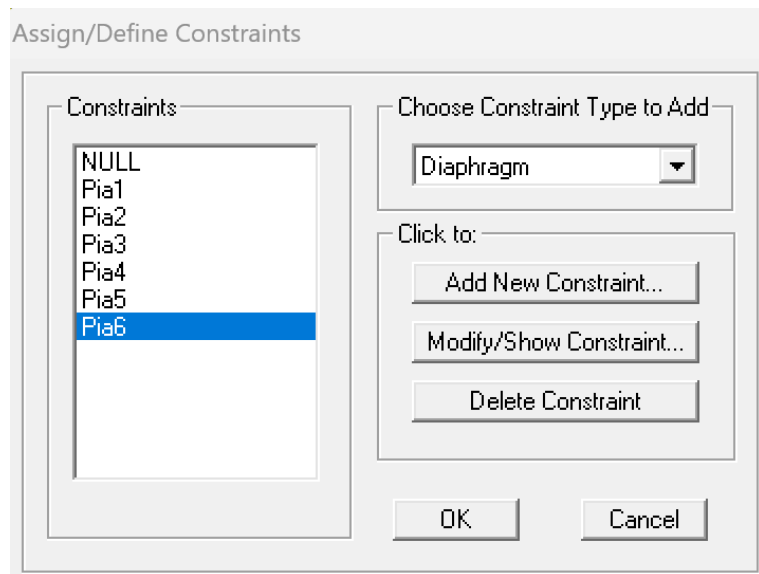
5. «Disegnare» gli elementi

Menu «Draw» → Comando «Draw Frame/Cable/Tendon»

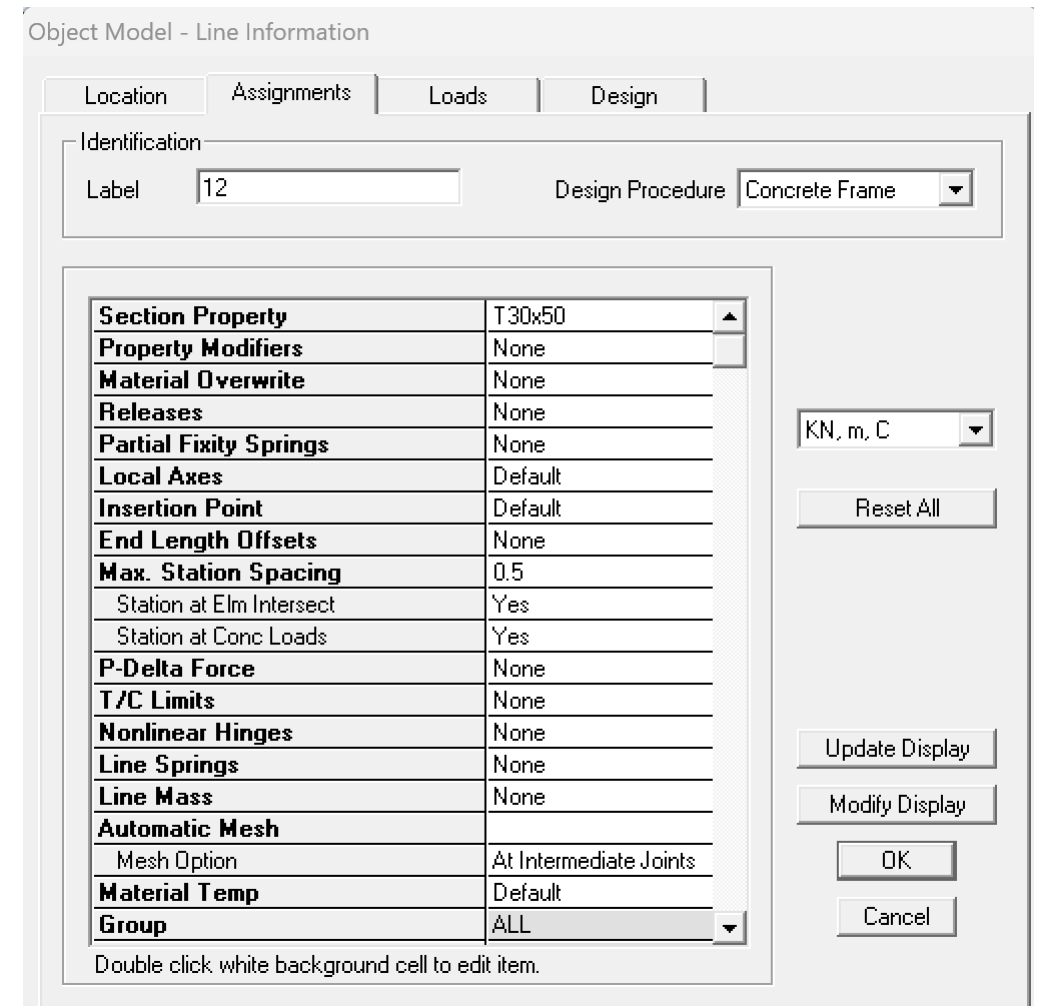
Usare i comandi «Replicate» e «Copy/Paste» per generare nuovi elementi strutturali da quelli già creati

6. Assegnare i vincoli





7. Assegnare gli impalcati rigidi



8. Cambiare nomi agli elementi strutturali

9. Definire i tipi di carico (Load pattern)

Define Load Patterns

Load Patterns

Load Pattern Name	Type	Self Weight Multiplier	Auto Lateral Load Pattern
Gd+Qd	OTHER	0	
Gd+Qd	OTHER	0	
Gk+PsiQk	OTHER	0	
Fh	QUAKE	0	None

Click To:

Add New Load Pattern

Modify Load Pattern

Modify Lateral Load Pattern...

Delete Load Pattern

Show Load Pattern Notes...

OK

Cancel

10. Definire i casi di carico (Load cases)

Define Load Cases

Load Case Name	Load Case Type
Gd+Qd	Linear Static
MODAL	Modal
Gk+PsiQk	Linear Static
Fh	Linear Static

Click to:

Add New Load Case...

Add Copy of Load Case...

Modify/Show Load Case...

Delete Load Case

Display Load Cases

Show Load Case Tree...

OK Cancel

Load Case Data - Linear Static

Load Case Name	Notes	Load Case Type
Gd+Qd	Modify/Show...	Static

Stiffness to Use

☒ Zero Initial Conditions - Unstressed State

☐ Stiffness at End of Nonlinear Case

Important Note: Loads from the Nonlinear Case are NOT included in the current case

Analysis Type

☒ Linear

☐ Nonlinear

☐ Nonlinear Staged Construction

Loads Applied

Load Type	Load Name	Scale Factor
Load Pattern	Gd+Qd	1.
Load Pattern	Gd+Qd	1.

Add

Modify

Delete

OK

Cancel

Frame Distributed Loads

Load Pattern Name: + Gd+Qd Units: KN, m, C

Load Type and Direction: ☒ Forces ☐ Moments
 Coord Sys: GLOBAL
 Direction: Z

Options: ☐ Add to Existing Loads ☒ Replace Existing Loads ☐ Delete Existing Loads

Trapezoidal Loads:

	1.	2.	3.	4.
Distance	0.	0.25	0.75	1.
Load	0.	0.	0.	0.

☒ Relative Distance from End-I ☐ Absolute Distance from End-I

Uniform Load: Load -65

OK Cancel

11. Assegnare i carichi per ciascun Load pattern

- Selezionare le travi ed assegnare il carico distribuito
- Selezionare i nodi ed assegnare le forze concentrate

Joint Forces

Load Pattern Name: + Gd+Qd Units: KN, m, C

Coordinate System: GLOBAL

Options: ☐ Add to Existing Loads ☒ Replace Existing Loads ☐ Delete Existing Loads

Loads:

Force Global X	0.
Force Global Y	0.
Force Global Z	-26
Moment about Global X	0.
Moment about Global Y	0.
Moment about Global Z	0.

OK Cancel

Set Load Cases to Run

Case Name	Type	Status	Action
Gd+Qd	Linear Static	Not Run	Run
MDD&L	Modal	Not Run	Do not Run
Gk+PsiQk	Linear Static	Not Run	Run
Fh	Linear Static	Not Run	Run

Click to:

Run/Do Not Run Case

Show Case...

Delete Results for Case

Run/Do Not Run All

Delete All Results

Show Load Case Tree...

Analysis Monitor Options

☐ Always Show

☐ Never Show

☒ Show After seconds

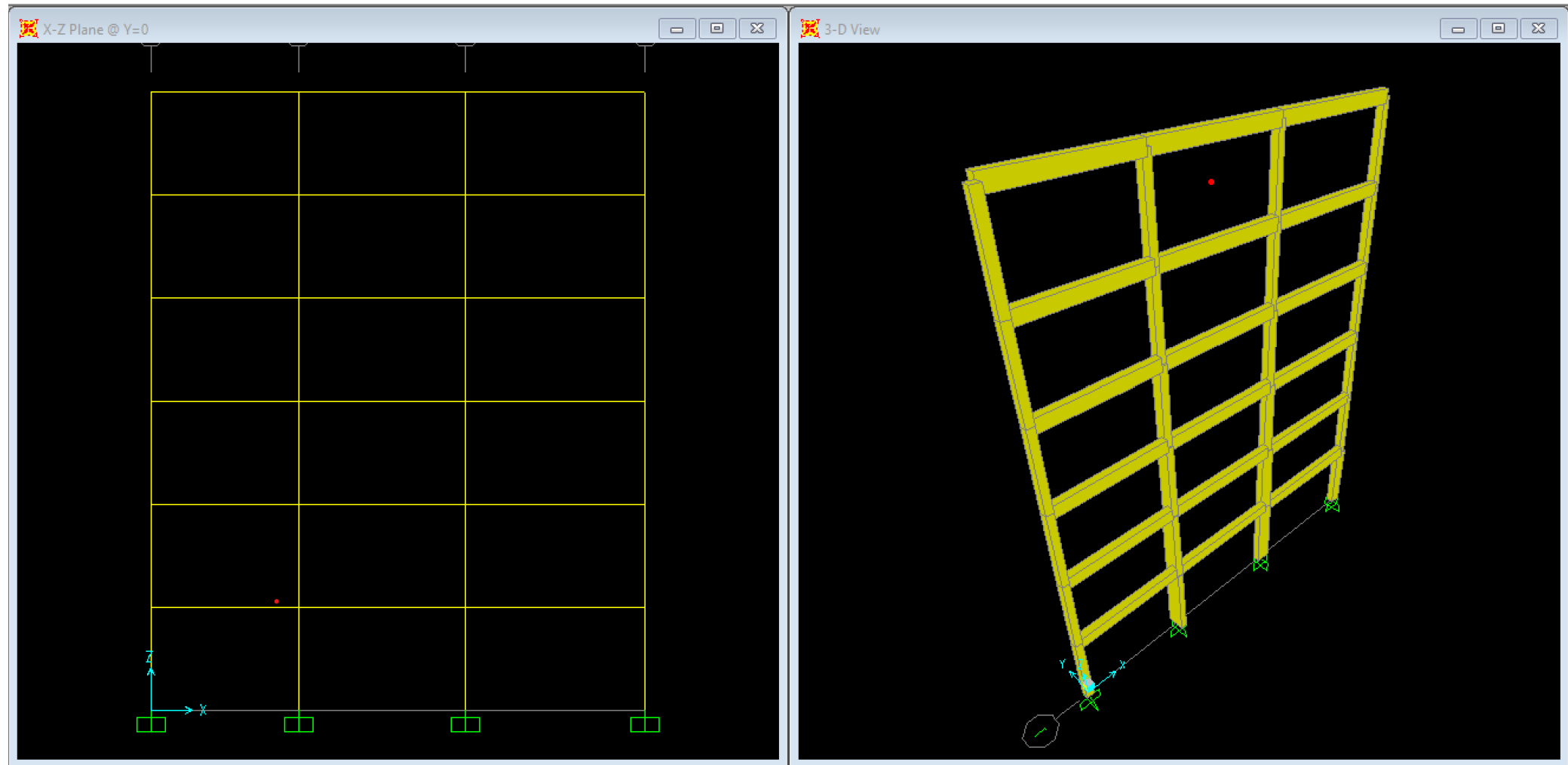
☐ Model-Alive

Run Now

OK Cancel

12. Eseguire le analisi

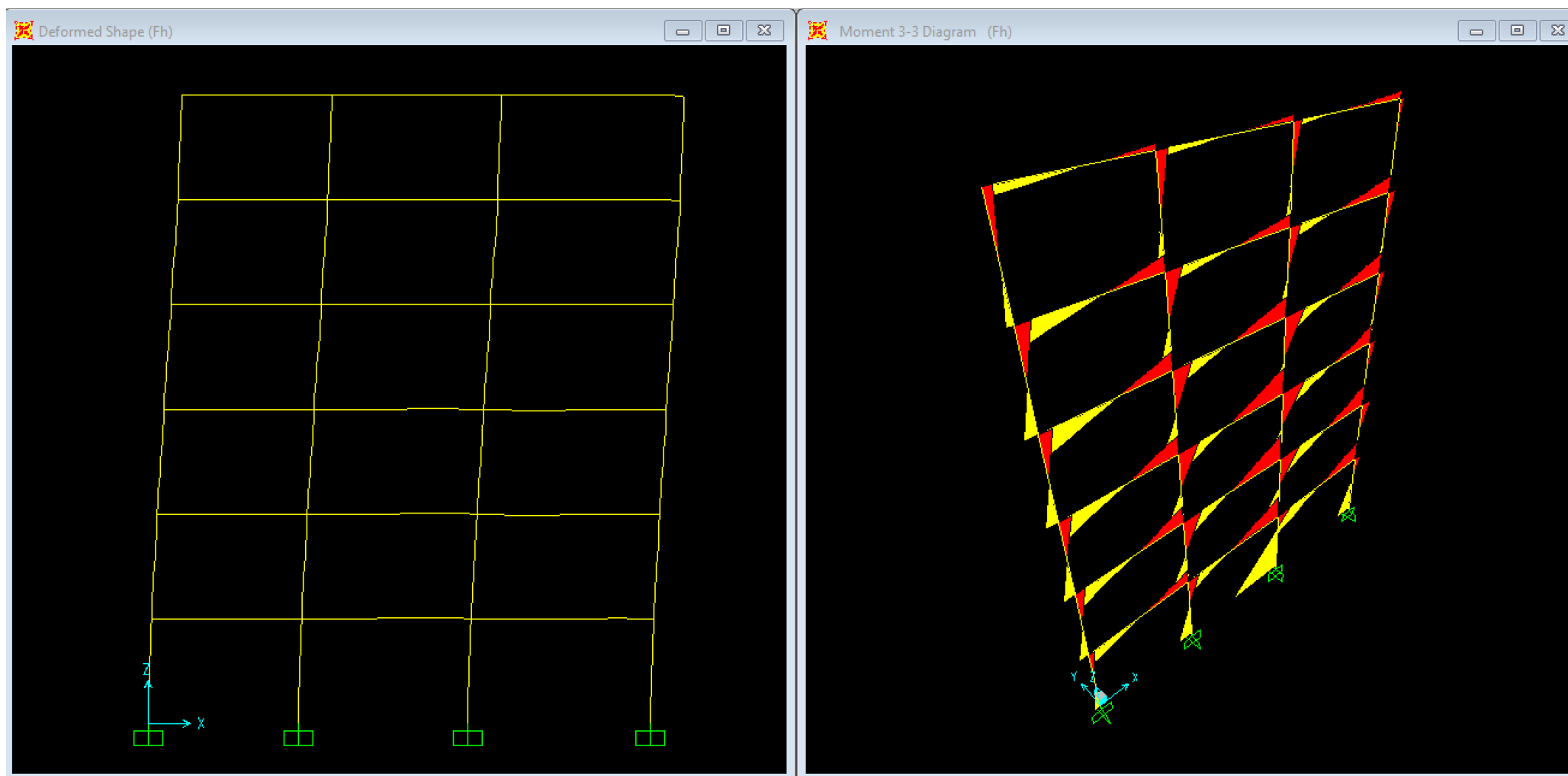
13. Visualizzare modello e risultati (Menù «Display»)



Vista modello nel piano

Vista 3D del modello

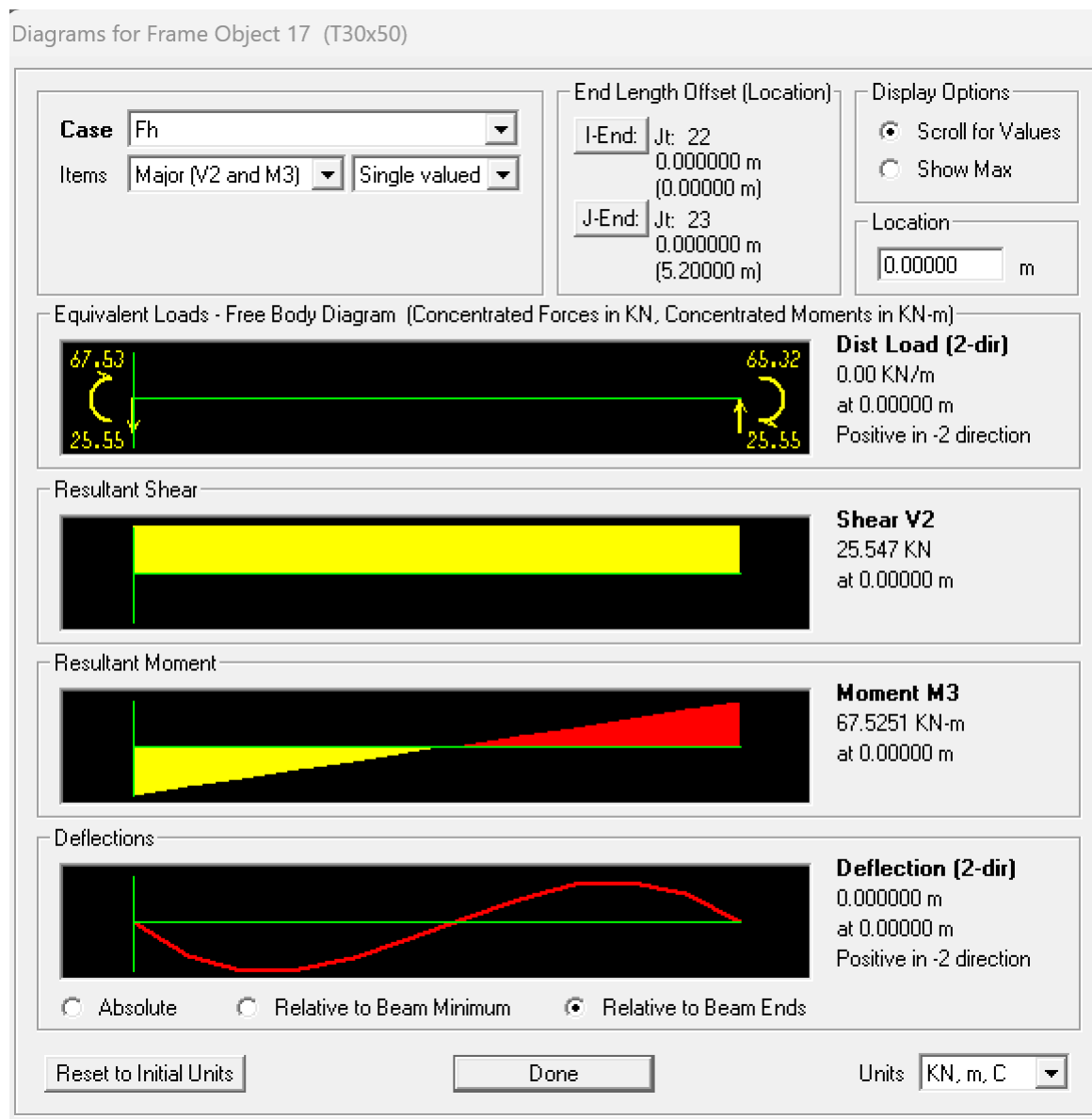
13. Visualizzare modello e risultati (Menù «Display»)



Deformata

Caratteristiche della sollecitazione

13. Visualizzare modello e risultati (Menù «Display»)



Risposta completa per singola asta

14. Stampare dati e risultati in tabelle

Choose Tables for Display

Edit

☐ MODEL DEFINITION (0 of 52 tables selected)

☐ System Data

☐ Property Definitions

☐ Load Pattern Definitions

☐ Other Definitions

☐ Load Case Definitions

☐ Bridge Data

☐ Connectivity Data

☐ Joint Assignments

☐ Frame Assignments

☐ Options/Preferences Data

☐ Miscellaneous Data

☒ ANALYSIS RESULTS (2 of 8 tables selected)

☐ Joint Output

☒ Element Output

☒ Frame Output

☐ Objects and Elements

☐ Structure Output

Load Patterns (Model Def.)

Select Load Patterns...

1 of 3 Selected

Load Cases (Results)

Select Load Cases...

3 of 3 Selected

Modify/Show Options...

Set Output Selections...

Options

☐ Selection Only

☐ Show Unformatted

Named Sets

Save Named Set...

Show Named Set...

Delete Named Set...

Table Formats File...

Current Table Formats File: Program Default

OK

Cancel

Element Forces - Frames

File View Format-Filter-Sort Select Options

Units: As Noted

Element Forces - Frames

	Frame Text	Station m	OutputCase Text	CaseType Text	P KN	V2 KN	V3 KN	T KN-m	M2 KN-m
▶	2	0	Gd+Qd	LinStatic	0	-173.46	0	0	0
	2	0.47273	Gd+Qd	LinStatic	0	-142.733	0	0	0
	2	0.94545	Gd+Qd	LinStatic	0	-112.006	0	0	0
	2	1.41818	Gd+Qd	LinStatic	0	-81.278	0	0	0
	2	1.89091	Gd+Qd	LinStatic	0	-50.551	0	0	0
	2	2.36364	Gd+Qd	LinStatic	0	-19.824	0	0	0
	2	2.83636	Gd+Qd	LinStatic	0	10.904	0	0	0
	2	3.30909	Gd+Qd	LinStatic	0	41.631	0	0	0
	2	3.78182	Gd+Qd	LinStatic	0	72.358	0	0	0
	2	4.25455	Gd+Qd	LinStatic	0	103.085	0	0	0
	2	4.72727	Gd+Qd	LinStatic	0	133.813	0	0	0
	2	5.2	Gd+Qd	LinStatic	0	164.54	0	0	0
	2	0	Gk+PsiQk	LinStatic	0	-88.068	0	0	0
	2	0.47273	Gk+PsiQk	LinStatic	0	-72.468	0	0	0
	2	0.94545	Gk+PsiQk	LinStatic	0	-56.868	0	0	0
	2	1.41818	Gk+PsiQk	LinStatic	0	-41.268	0	0	0
	2	1.89091	Gk+PsiQk	LinStatic	0	-25.668	0	0	0
	2	2.36364	Gk+PsiQk	LinStatic	0	-10.068	0	0	0
	2	2.83636	Gk+PsiQk	LinStatic	0	5.532	0	0	0
	2	3.30909	Gk+PsiQk	LinStatic	0	21.132	0	0	0

Record: 1 of 864

Add Tables... Done

È possibile personalizzare la tabella e salvare il formato per riutilizzarlo su altre tabelle

Modify/Show Database Table Format

Format

Filter

Sort

Format for M2 Field

General

☐ Include Field in Report

☐ Repeat Field if Table is Split

☐ Force a Table Split After this Field

Field Alignment and Width

Field Alignment

Right

Units for Field Width

Millimeters

Field Width

0.0315

Floating Point Number Format

Max Number of Characters

12

Zero Tolerance

1.000E-20

Number of Decimal Places

4

Min Num of Significant Figures

2

Always use E Format

No

Units (Type: Moment)

Display Field in these Units

KN, m, C

☒ Always Display in Current Units

Reset to Program Default Field Format

Selected Field

All Fields

Display Order and Field Visibility

Double-Click Row to Toggle Visibility

	Item	Field Name
1	Printed	Frame
2	Printed	Station
3	Printed	OutputCase
4	Printed	CaseType
5	Not Printed	P
6	Printed	V2
7	Not Printed	V3
8	Not Printed	T
9	Not Printed	M2
10	Printed	M3
11	Printed	FrameElem
12	Printed	ElemStation

Reset Display Order to Default

Apply Format to Table

Apply Format from File

Apply Program Default Format

Save to DB Table Formats File

Save Table Format to File

OK

Cancel

Element Forces - Frames

File View Format-Filter-Sort Select Options

Units: As Noted

Element Forces - Frames

	Frame Text	Station m	OutputCase Text	CaseType Text	V2 KN	M3 KN-m	FrameElem Text	ElemStation m
▶	2	0	Gd+Qd	LinStatic	-173.46	-154.3485	2-1	0
	2	0.47273	Gd+Qd	LinStatic	-142.733	-79.6121	2-1	0.47273
	2	0.94545	Gd+Qd	LinStatic	-112.006	-19.4012	2-1	0.94545
	2	1.41818	Gd+Qd	LinStatic	-81.278	26.2841	2-1	1.41818
	2	1.89091	Gd+Qd	LinStatic	-50.551	57.4437	2-1	1.89091
	2	2.36364	Gd+Qd	LinStatic	-19.824	74.0777	2-1	2.36364
	2	2.83636	Gd+Qd	LinStatic	10.904	76.1861	2-1	2.83636
	2	3.30909	Gd+Qd	LinStatic	41.631	63.7688	2-1	3.30909
	2	3.78182	Gd+Qd	LinStatic	72.358	36.826	2-1	3.78182
	2	4.25455	Gd+Qd	LinStatic	103.085	-4.6425	2-1	4.25455
	2	4.72727	Gd+Qd	LinStatic	133.813	-60.6366	2-1	4.72727
	2	5.2	Gd+Qd	LinStatic	164.54	-131.1563	2-1	5.2
	2	0	Gk+PsiQk	LinStatic	-88.068	-78.4577	2-1	0
	2	0.47273	Gk+PsiQk	LinStatic	-72.468	-40.5128	2-1	0.47273
	2	0.94545	Gk+PsiQk	LinStatic	-56.868	-9.9424	2-1	0.94545
	2	1.41818	Gk+PsiQk	LinStatic	-41.268	13.2535	2-1	1.41818
	2	1.89091	Gk+PsiQk	LinStatic	-25.668	29.0748	2-1	1.89091
	2	2.36364	Gk+PsiQk	LinStatic	-10.068	37.5216	2-1	2.36364
	2	2.83636	Gk+PsiQk	LinStatic	5.532	38.5938	2-1	2.83636
	2	3.30909	Gk+PsiQk	LinStatic	21.132	32.2915	2-1	3.30909
	2	3.78182	Gk+PsiQk	LinStatic	36.732	18.6147	2-1	3.78182

Record: 1 of 864

Add Tables...

Done

15. Esportare i risultati tabellati su EXCEL

FileHomeInserisciDisegnoLayout di paginaFormuleDatiRevisioneVisualizzaSviluppoGuidaCondividi

Incolla

Appunti

Calibri11

G C S A A

Carattere

Allocazione

Generale

Formattazione condizionale

Formatta come tabella

Stili cella

Celle

Modifica

A4

2

	A	B	C	D	E	F	G	H	I	J	K
1	TABLE: Element Forces - Frames										
2	Frame	Station	OutputCase	CaseType	V2	M3	FrameElem	ElemStation			
3	Text	m	Text	Text	KN	KN-m	Text	m			
4	2	0	Gd+Qd	LinStatic	-173.46	-154.3485	2-1	0			
5	2	0.47273	Gd+Qd	LinStatic	-142.733	-79.6121	2-1	0.47273			
6	2	0.94545	Gd+Qd	LinStatic	-112.006	-19.4012	2-1	0.94545			
7	2	1.41818	Gd+Qd	LinStatic	-81.278	26.2841	2-1	1.41818			
8	2	1.89091	Gd+Qd	LinStatic	-50.551	57.4437	2-1	1.89091			
9	2	2.36364	Gd+Qd	LinStatic	-19.824	74.0777	2-1	2.36364			
10	2	2.83636	Gd+Qd	LinStatic	10.904	76.1861	2-1	2.83636			
11	2	3.30909	Gd+Qd	LinStatic	41.631	63.7688	2-1	3.30909			
12	2	3.78182	Gd+Qd	LinStatic	72.358	36.826	2-1	3.78182			
13	2	4.25455	Gd+Qd	LinStatic	103.085	-4.6425	2-1	4.25455			
14	2	4.72727	Gd+Qd	LinStatic	133.813	-60.6366	2-1	4.72727			
15	2	5.2	Gd+Qd	LinStatic	164.54	-131.1563	2-1	5.2			
16	2	0	Gk+PsiQk	LinStatic	-88.068	-78.4577	2-1	0			
17	2	0.47273	Gk+PsiQk	LinStatic	-72.468	-40.5128	2-1	0.47273			
18	2	0.94545	Gk+PsiQk	LinStatic	-56.868	-9.9424	2-1	0.94545			
19	2	1.41818	Gk+PsiQk	LinStatic	-41.268	13.2535	2-1	1.41818			
20	2	1.89091	Gk+PsiQk	LinStatic	-25.668	29.0748	2-1	1.89091			
21	2	2.36364	Gk+PsiQk	LinStatic	-10.068	37.5216	2-1	2.36364			
22	2	2.83636	Gk+PsiQk	LinStatic	5.532	38.5938	2-1	2.83636			
23	2	3.30909	Gk+PsiQk	LinStatic	21.132	32.2915	2-1	3.30909			
24	2	3.78182	Gk+PsiQk	LinStatic	36.732	18.6147	2-1	3.78182			
25	2	4.25455	Gk+PsiQk	LinStatic	52.332	-2.4368	2-1	4.25455			

Element Forces - Frames

Program Control

Pronto

100%